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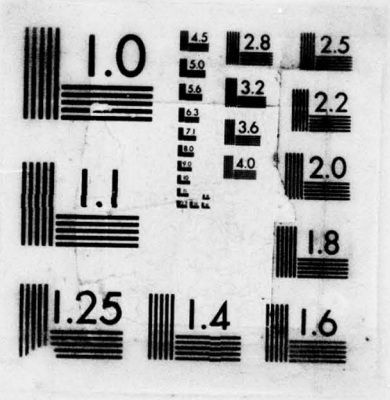
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TECHNICAL REPORT Y-78-5

PRELIMINARY GUIDE TO WETLANDS OF THE GULF COASTAL PLAIN

Major Associations and Communities Identified

Environmental Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

May 1978
Final Report

Prepared for Office, Chief of Engineers, U. S. Army
Washington, D. C. 20314

PRELIMINARY GUIDE TO WETLANDS

Major Associations and Communities Identified

Technical Report No.	Region
Y-78-2	Peninsular Florida
Y-78-3	Puerto Rico
Y-78-4	West Coast States
Y-78-5	Gulf Coastal Plain
Y-78-6	Interior-Great Lakes
Y-78-7	South Atlantic States
Y-78-8	North Atlantic States
Y-78-9	Alaska

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IN REPLY REFER TO: WESYV

15 June 1978

SUBJECT: Transmittal of Technical Report Y-78-5

TO: All Report Recipients

1. The report transmitted herewith provides preliminary guidance on wetland determination to Corps of Engineers personnel responsible for the implementation of Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) in the Gulf Coastal Plain. This guide, sponsored by the Office, Chief of Engineers, represents one of a series of eight guides to the major wetland associations of the United States. Other guides include Puerto Rico, Alaska, South Atlantic States, peninsular Florida, North Atlantic States, Interior-Great Lakes, and West Coast States.

2. The guide is intended to assist in the field recognition of major wetland communities as they relate to the determination of jurisdictional boundaries in the implementation of the Section 404 permit program. It is neither a regional flora manual nor a general classification system. Several manuals that identify the flora of the Gulf Coastal Plain are referenced in this document and personnel requiring species identification are referred to those works. Personnel requiring a detailed wetland classification system may wish to consult "Classification of Wetland and Deep-Water Habitats of the United States (an operational draft)," prepared by the National Wetland Inventory Project of 1975-79 of the U. S. Fish and Wildlife Service.

JOHN L. CANNON
Colonel, Corps of Engineers
Commander and Director

Unclassified

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This guide to the major plant associations and communities found in wetlands within the Gulf Coastal Plain is one of a series of eight such guides, each prepared by a specialist or specialists familiar with the wetlands in the region covered by the guide. The guides are intended for distribution to the various U. S. Army Engineer Districts for use in wetland identification in the implementation of Section 404 of the Federal Water Pollution Control Act Amendments of 1972. The classification system in the guide is intended solely for use in the Section 404 permit program and is not considered a classification system for other purposes.

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SUMMARY

This report represents one of a series of eight preliminary guides to the dominant plant associations and communities found in the major wetlands of the United States. The primary purpose of the guidebook is to aid regulatory functions personnel in recognizing and delineating wetlands subject to permit regulation under Section 404 of Public Law 92-500 (Federal Water Pollution Control Act Amendments of 1972).

The guidebook is designed to be self-contained and consists of three parts. An introduction covers the purpose and use of the guidebook as well as general information about Section 404 wetlands. The second part, entitled "Wetlands," consists of three major sections: Regional Environment, Regional Botanical References, and Wetland Types. The section on regional environment is brief and provides a broad context for the more detailed descriptions of the dominant plant associations and communities found in the major wetlands of the region. Because of synonymy of many scientific names, the nomenclature standard used for the guide is presented in the section on regional botanical references. Detailed description of wetland vegetation is based upon data in the literature and information from scientists having familiarity with the region. The goal of this section is to provide a description sufficiently detailed for field use but not to report minor variations of each wetland. Thus, the descriptions are a compromise between site-specific reports and extremely general discussions. The third part contains references to pertinent publications and Appendices A-C and is specific to the region; Appendix B, a glossary that is common to all guides in the series, has been added to aid in the user's clarity of understanding.

PREFACE

At the request of the Office, Chief of Engineers (OCE), the Environmental Laboratory (EL) of the Waterways Experiment Station (WES) initiated production of this report, one of a series of eight preliminary guides to the dominant plant associations and communities found in the country's major wetlands. Other reports in the series apply to Alaska, West Coast, Interior, peninsular Florida, North Atlantic, South Atlantic, and Puerto Rico. The reports are listed on the inside of the front cover. Funding was provided by OCE.

Dr. D. G. Rhodes, Professor of Botany, Louisiana Tech University, provided a manuscript for initial construction of the draft guide. Mr. Richard H. Daley, Ecologist, Missouri Botanical Gardens, St. Louis, provided major review and rewriting of the draft copy under Purchase Order DACW39-76-M-5173. Preparation of the guide was initiated by Dr. Luther F. Holloway, Research Botanist, EL. Dr. Gary E. Tucker, Research Botanist, EL, directed the production of the guide with the assistance of Dr. Robert Terry Huffman, Research Botanist, EL. Dr. G. N. Montz, U. S. Army Engineer District, New Orleans, provided many reports that assisted in the preparation of this guide. Ms. Dorothy P. Booth, EL, served as technical editor. The illustration used on the covers of this series of reports was drawn by Ms. Jane Barnes, Russellville, Arkansas.

The guide project was under the general supervision of Dr. H. K. Smith, Project Manager, Habitat Development Project; Dr. C. J. Kirby, Chief, Environmental Resources Division; Dr. Roger T. Saucier, Special Assistant, Dredged Material Research Program; and Dr. John Harrison, Chief, EL.

The Commanders and Directors of WES during the study were COL G. H. Hilt, CE, and COL J. L. Cannon, CE. Technical Director was Mr. F. R. Brown.

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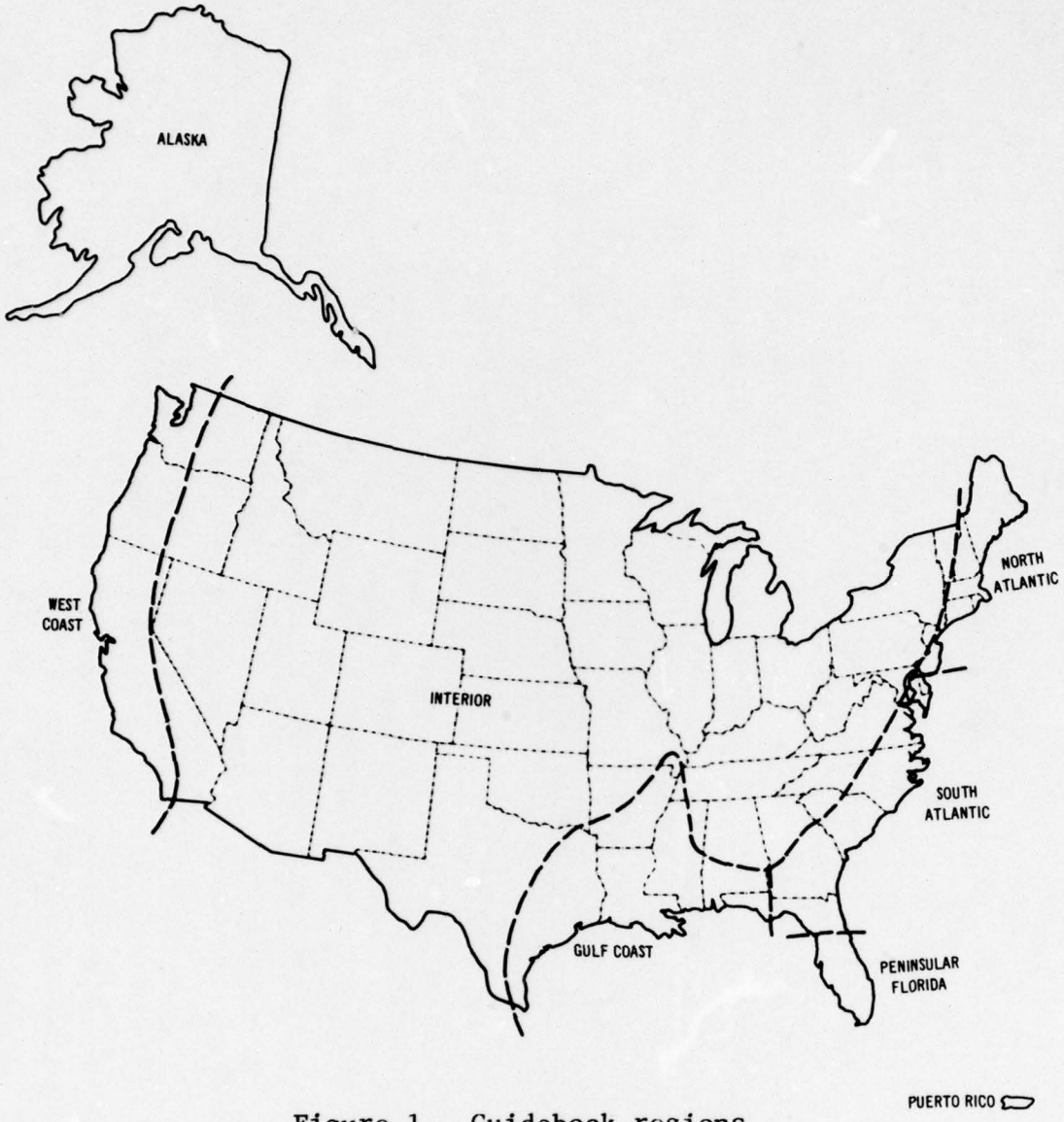

Figure 1. Guidebook regions

PRELIMINARY GUIDE TO THE WETLANDS OF THE GULF COASTAL PLAIN
Major Associations and Communities Identified

PART I: INTRODUCTION

1. This guide to the major plant communities and associations found in wetlands within the Gulf Coastal Plain is one of a series of eight such regional guides, each prepared by a specialist or specialists familiar with the wetlands in the region covered by the guide. Other regional guides include Alaska, West Coast, Interior, peninsular Florida, North Atlantic, South Atlantic, and Puerto Rico (Figure 1). The guides are intended for distribution to the various U. S. Army Engineer District regulatory functions personnel for use in identification of wetlands for the implementation of Section 404 of the Federal Water Pollution Control Act Amendments of 1972. The information provided is intended solely for use in the Section 404 permit program and is not considered a definitive classification system for other purposes.

2. Field personnel having need of a more detailed and definitive system of classification per se should consult one of the several wetland classification systems currently in use in the United States and Canada. The well-known Circular 39 (Shaw and Fredine, 1956) of the U. S. Fish and Wildlife Service has met with widespread use nationally despite its well-documented shortcomings. A recently published operational draft by the Fish and Wildlife Service (Cowardin et al., 1977) represents the most recent product of the National Wetland Inventory Project of 1975-79, an intensive effort that will result ultimately in the publication of a detailed and refined classification system to the wetlands of the entire nation. Numerous regional systems of classification also are available. Among the more significant regional classification systems are those of Golet and Larson (1974), Millar (1976), Odum et al. (1974), Penfound (1952), Stewart and Kantrud (1971), and Zoltai et al. (1975).

Section 404 Permit Program

Authority

3. Under the laws of the United States, Congress has assigned a number of nonmilitary functions to the U. S. Army Corps of Engineers. In addition to the well-known and more traditional roles in flood control, hydropower production, navigation, water supply storage, and recreation, the Corps has responsibility for some activities that are not so well known. Congress has given the Corps of Engineers regulatory responsibility to protect navigation channels and harbors against encroachments and also to preserve and restore water quality by regulating the discharge of dredged or fill material into waterways and wetlands.

4. The primary legislative basis for the Corps' regulatory authority for the disposal of dredged or fill material is the Federal Water Pollution Control Act Amendments of 1972. Section 404 of that Act gives authority to the Secretary of the Army, acting through the Chief of Engineers, to regulate the discharge of dredged or fill material in the waters of the United States.

5. Regulatory authority under Section 404 was initially considered limited to waters that are used presently, were used in the past, or could be used through reasonable improvements to transport interstate commerce. Limitation of the Corps' regulatory authority under Section 404 to navigable waters of the United States was successfully challenged in the District Court for the District of Columbia. On 27 March 1975, the Court ordered the Corps to extend its jurisdictional responsibility for the discharge of dredged or fill material under Section 404 to all waters of the United States (including the territorial seas) and adjacent wetlands and to revise its regulations accordingly.

6. In accordance with the Court's 1975 directive, the Corps of Engineers published an interim regulation in the Federal Register on 25 July 1975. The final set of permit regulations, considerably revised and reorganized, was published in the Federal Register on 19 July 1977.

Scope

7. The Corps of Engineers permit program under Section 404 is extended to many areas that have never been regulated before. In

addition to the navigable waters of tradition, the Corps has been given jurisdictional authority over tributaries to navigable waters, including adjacent wetlands; interstate waters and their tributaries, including adjacent wetlands; and all other waters of the United States, such as lakes and rivers and streams that are not interstate waters or part of a tributary system to navigable waters of the United States; impoundments; perched wetlands; intermittent streams; and prairie potholes, the degradation or destruction of which could affect interstate commerce. In the absence of adjacent wetlands that are a part of the waters described previously, the landward limit of jurisdiction in tidal waters shall be the high tide line and the shoreward limit of jurisdiction in all other waters shall be the ordinary high water mark.

8. The term "wetlands" is a very crucial part of Section 404 and refers to those areas that are inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Appendix C).

Purpose

9. The purpose of the Section 404 program, which is a part of the Corps of Engineers' overall regulatory authority, is to ensure that the chemical and biological integrity of waters of the United States is protected from unregulated discharges of dredged or fill material that could permanently alter or destroy the character of these invaluable natural resources.

Importance and Values of Wetlands

10. Wetlands are valuable and productive natural resources of national significance, and some of their major functions include the following:

a. The provision of feeding, cover, and reproduction habitat for a great diversity of species, including endangered and threatened species.

b. The provision of educational, study, refuge and sanctuary, and recreational areas.

c. The maintenance of drainage, salinity, sedimentation, flushing, and current patterns.

d. Cycling of nutrients.

e. Reduction of contaminant loading.

f. Protection from erosion and storm damage.

Geographical Regions

11. Eight geographical regions have been defined for the wetlands guidebook series: Alaska, West Coast, Interior, Gulf Coast, North Atlantic, South Atlantic, peninsular Florida, and Puerto Rico. The geographical regions are based on both physiographic and pragmatic considerations; the boundaries were influenced significantly by the works of Fenneman (1931, 1938). The use of natural units rather than artificial ones, such as political boundaries, minimizes the number of wetland types described in each guidebook. Several states are covered by a combination of two guidebooks, and a very few are covered by three guidebooks. Physiographic parameters were used where possible, since both hydrologic and biotic patterns are related closely to landscape features. Each of the regions will be covered in a separate guidebook. Geographic descriptions for the guides are as follows:

a. Alaska. The state of Alaska is the sole subject of an entire guide. Particular emphasis is placed on coastal wetlands; much of the interior region is "wet," but further study is necessary to determine the exact jurisdictional limits of Section 404.

b. West Coast. This region includes most of California (exclusive of the southeastern part), western Oregon, and western Washington.

c. Interior. The area covered by this region consists of the vast interior of the United States, including much of the Southwest, the Rockies and some of the intermontane region, the Central Plains, and the Midwest. States contained within the region are numerous.

d. Gulf Coast. The Gulf Coast region extends from the coastal plain of Texas to western Georgia (Figure 2). Inland, the coastal plain extends to southern Illinois in the Mississippi embayment; other states included in the

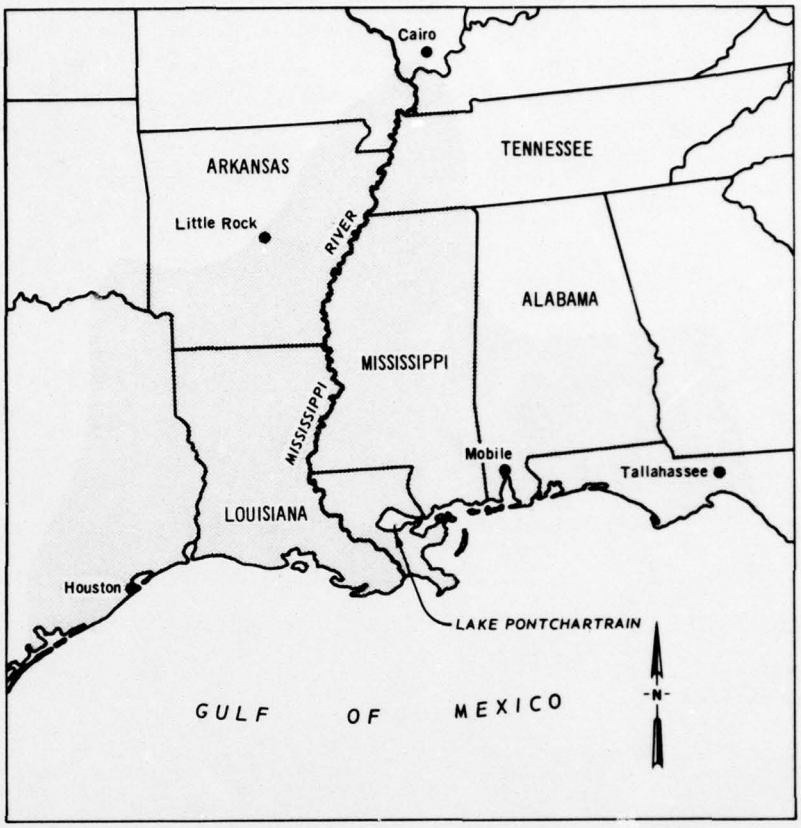

Figure 2. Map of the Gulf Coastal Plain

region are all or parts of Oklahoma, Arkansas, Louisiana, Mississippi, Alabama, Florida, and Tennessee.

e. North Atlantic. This region extends north from Sandy Hook, New Jersey, to the Canadian border and west to the Appalachian highlands. Included within the region is northern New Jersey, New York, and New England.

f. South Atlantic. Included within this region is everything north from peninsular Florida to Sandy Hook, New Jersey, and west to the Appalachian highlands. The separation of this region from the North Atlantic region is based largely on substrate features; the exposures of bedrock throughout the North Atlantic region are strikingly different from the thick mantle of Coastal Plain sediments predominating in most of the South Atlantic region. Additionally, most of the species of the "southern" swamp forest are restricted to the South Atlantic region as defined here.

g. Peninsular Florida. There is no clear physiographic distinction between peninsular Florida and the Gulf Coast and Atlantic Coast regions, but the vegetation of peninsular Florida has strong enough tropical affinities to warrant separate treatment. The peninsular region has

been delineated by an arbitrary boundary extending from Jacksonville west to Steinhatchee, with all of Florida south of the boundary included in the region. "Subtropical Florida" as defined by Fenneman (1931) and Braun (1964) is essentially conspecific with this region.

h. Puerto Rico. The guidebook is intended for use in Puerto Rico; however, its utility may extend to the U. S. Virgin Islands because the vegetation of the two regions has many similarities.

Wetland Types

General information

12. Nine basic wetland types are recognized in the United States (Figure 3). An interpretation of the definition of wetlands is given in Appendix C. The number of wetland types in each guidebook region,

	Alaska	West Coast	Interior	Gulf Coast	North Atlantic	South Atlantic	Peninsular Florida	Puerto Rico
Saltwater Aquatic	✓	✓	✓	✓	✓	✓	✓	✓
Saltwater Coastal Flat	✓	✓	x	✓	✓	✓	✓	✓
Saline Inland Flat	x	x	✓	x	x	x	x	x
Saltwater Marsh	✓	✓	✓	✓	✓	✓	✓	✓
Saltwater Swamp	x	✓	x	✓	x	x	✓	✓
Freshwater Aquatic	✓	✓	✓	✓	✓	✓	✓	✓
Freshwater Flat	✓	✓	✓	✓	✓	✓	✓	✓
Freshwater Marsh	✓	✓	✓	✓	✓	✓	✓	✓
Freshwater Swamp	✓	✓	✓	✓	✓	✓	✓	✓

✓ - present

x - absent

Figure 3. Distribution of wetland types by region

however, is either seven or eight, since no region has all possible types. The nine basic wetland types have been distinguished by a combination of differences in physiognomy (e.g., marsh versus swamp), growth form (e.g., herbaceous plants versus trees), and environmental factors (such as degree of salinity in soil and water) Terms used on a regional basis in the description and definition of wetlands, such as bog and pocosin, are discussed in the text at appropriate points.

Identification

13. The approach to the identification of wetlands in this guidebook series is to provide general classifications for each region of the country. For purposes of this series, the country has been divided into six large regions plus Alaska and Puerto Rico (as described earlier). Within each regional guide, a key (Table 1) is provided for classification of any site in question. The reader is then referred to a brief description of the type (Wetland Types, next section) for a preliminary check to see if the site was properly classified. Finally, the reader is referred to the text for a more complete description of the communities and associations in the wetland and a pictorial profile illustrating its dominant species. The description of each wetland association is concluded with a section entitled "Field Identification," which briefly explains how to distinguish the wetland from other wetland types and from adjacent uplands. The entire description of a wetland should be studied prior to using the field identification section, however, to familiarize the user with its major variations. Wherever feasible, characteristics of growth forms are highlighted for identification, but if classification of an area is questionable, final determination must be based upon species composition.

14. If a site "fits" the description reasonably well, then the decision is clear that the area should be classified as a wetland of that particular type. The converse is not true, however. (If the site does not closely match one of the descriptions, it cannot be concluded unequivocally that the area is not a wetland.) This text is written from a regional perspective and consequently cannot be comprehensive and describe all variations within each wetland type. If a site does not

Table 1

Key to Wetland Types

A. Aquatic vegetation predominant (dominant plants free-floating or attached and having poorly developed tissues of structural support, supported and buoyed up by the water); flooded usually for long periods or permanently	
B. Coastal; below the intertidal zone; seaward to limits of vascular plant growth; permanently flooded	SALTWATER AQUATIC
B. Inland; flooded permanently or semipermanently by fresh water	FRESHWATER AQUATIC
A. Terrestrial vegetation predominant (dominant plants rooted and with well-developed tissues of structural support) or sometimes barren of vegetation; flooded at least occasionally, often for prolonged periods	
C. 25 percent or less vegetative cover	
D. Subject to saltwater influence	
E. Coastal, tidal	SALTWATER COASTAL FLAT
E. Inland, nontidal	SALINE INLAND FLAT*
D. Fresh water	FRESHWATER FLAT
C. More than 25 percent vegetative cover	
F. Nonsaline soils	
G. 40 percent or less cover by woody plants	FRESHWATER MARSH
G. More than 40 percent cover by woody plants	FRESHWATER SWAMP
F. Saline (including brackish) soils	
H. 40 percent or less cover by woody plants	SALTWATER MARSH
H. More than 40 percent cover by woody plants	SALTWATER SWAMP

* The saline inland flat does not occur in the Gulf Coastal Plain.

Table 1 (Continued)

How to use the key: A key is an artificial device constructed for the purpose of identifying an unknown object. Keys traditionally have been used in the field of biology for the identification of unidentified plant and animal species, but in this guidebook the key will be used for the identification of unidentified wetland types.

The key to wetland types consists of a series of contrasting statements or descriptions, and the user of the key is required to make decisions based on the comparison of statements in the key as related to observations on the unidentified wetland type. The user must work carefully through the key from its beginning until a wetland type has been selected for the area in question.

The key is constructed around a series of pairs of leads. The second lead of a pair usually repeats the data given in the first lead but in a negative sense. Let us assume that you, the user of the guidebook, have located a grass-dominated area that obviously is "wet" during the better part of the year and obviously under the jurisdiction of the Section 404 program. Proper use of the key should enable you to determine just what type of wetland is involved.

In order to begin use of the key, you must start with the first pair of lead sentences, in this case labelled "A." Read each lead carefully, weighing one against the other with relation to your grass-dominated area. Grasses normally do not grow as free-floating organisms nor do they depend on water to buoy them upright, since they normally have sufficient supporting tissues to grow erect; in this case, then, the second lead of the pair of choices is better descriptive of the grass-dominated area with which you are concerned. You are now ready to consider a second pair of leads. This time you will consider the leads labelled "C" (of course, if your habitat were dominated by aquatic vegetation rather than terrestrial grasses, you would be considering the choices labelled "B"). Read the two "C" leads carefully, look at your grassy area, and try to determine how much of the ground surface is covered by vegetation. If less than 25 percent of the ground surface is covered by vegetation and more than 75 percent of the area is bare ground, you will select the first "C" as indicated; if vegetative cover accounts for more than 25 percent cover, you will take the second choice labelled "C." Let us assume that your area has only 10 percent cover. You will select the first "C" and then proceed to the "D" possibilities. Is the area in question flooded by fresh water or salt water? Let us make the assumption that you are in a freshwater area; look at the key carefully and note that the second "D" lead has a series of dotted lines leading to the phrase "Freshwater Flat." After the process of first rejecting and then accepting leads, you finally have arrived at an identification of your wetland type.

Table 1 (Concluded)

After determining the wetland type of an area in question, the user should turn to the detailed description of that particular type in the guidebook. In our hypothetical case the user would turn to page 45, FRESHWATER FLAT, and carefully read the descriptive material.

The use of the key may not be as simple and easy as it may seem. After you have followed the key through until coming to an identification of the wetland type, it may appear that the wetland description does not seem to fit the site. In that case it always pays to go back to the key and make sure an error has not been made through haste or misunderstanding of terms used. Occasionally an area may be found that cannot be identified with the aid of the key; the entire guidebook is written from a regional perspective and does not cover all variations of each wetland type. If a site does not fit any of the wetland types as described but yet is suspected of being a wetland under Section 404, a professional ecologist or botanist may be required for a quantitative study of the vegetation at the site.

fit any of the descriptions yet is still suspected to be a wetland, a quantitative survey of the vegetation of the area will be necessary. Especially in cases where the natural vegetation cannot be ascertained, hydrologic and soil information will be required to determine whether or not a site is a wetland. The nine basic wetland types are defined as follows:

a. Saltwater aquatic. Wetlands that are dominated by free-floating, rooted, or otherwise attached herbaceous plants (including macroscopic marine algae) and that are permanently flooded by saline or brackish water (e.g., sea grass beds).

b. Saltwater coastal flat. Wetlands that have 25 percent or less vegetative cover and are occasionally (shallow flat) or regularly (deep flat) flooded by saline water of tidal origin (e.g., nonvegetated intertidal zone).

c. Saline inland flat. Wetlands that have 25 percent or less vegetative cover and are occasionally or regularly flooded by saline water of nontidal origin (e.g., inland salt flat).

d. Saltwater marsh. Wetlands that have more than 25 percent vegetative cover of herbaceous plants but 40 percent* or less cover by woody plants and that are occasionally (high marsh) or regularly (low marsh) flooded by brackish or saline water (e.g., Smooth cordgrass marshes).

e. Saltwater swamp. Wetlands that have more than 40 percent cover of woody plants and are occasionally or regularly flooded by brackish or saline water (e.g., mangrove swamps).

f. Freshwater aquatic. Wetlands that are usually dominated by free-floating or rooted aquatic herbs and are semipermanently or permanently flooded by fresh water (e.g., floating duckweed mats).

g. Freshwater flat. Wetlands that have 25 percent or less vegetative cover and are occasionally or regularly flooded by fresh water (e.g., mudflats).

h. Freshwater marsh. Wetlands that have more than 25 percent vegetative cover of herbaceous plants but 40 percent or

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* The use of 40 percent as the division for woody plant cover is convenient for field work because when the tree cover is 40 percent, the distance between tree crowns equals the mean radius of a tree crown (UNESCO, 1973).

less cover by woody plants that are occasionally or regularly flooded by fresh water (e.g., cattail marsh).

i. Freshwater swamp. Wetlands that have more than 40 percent cover by woody plants and are occasionally or regularly flooded by fresh water (e.g., cypress swamps).

Organization of Guidebooks

15. Each guidebook is designed to be self-contained. Although this necessitates repetition of general information in the introductory part, the advantages in utility outweigh the duplication. The second part of each guidebook, entitled "Wetlands by Region," is the only one of the three parts unique with each guide. The third part, containing appendixes and references to pertinent publications, is largely specific for each region, except for a glossary that is common to the entire group of regional guides.

16. Three major sections are found in Part II: Regional Environment, Regional Botanical References, and Wetland Types. The section on regional environment is brief and provides a broad context for the more detailed descriptions of wetland types in each region. Because of the synonymy of many scientific names, the standard used for the guide is given in the section on regional botanical references.

17. Description of each wetland type is based upon data in the literature and from discussions with scientists having familiarity with the area. The goal is to provide a sufficiently detailed description for use in the field but not to report every possible variation of each wetland type. Thus, the descriptions are a comparison between site-specific reports and extremely general discussions.

18. The description of vegetation in each wetland type is divided into the following four parts:

a. Growth form. Growth form, such as deciduous (e.g., Ash, Bald cypress) or evergreen (e.g., pine, Southern magnolia) trees, is a concise description based upon the physiognomy of the vegetation. This should be particularly helpful to those not familiar with the species in the area.

b. Species composition. Discussion of species composition in each case includes listings in alphabetical order (by scientific name) of the dominant plants and the most commonly associated species. Because of local variation within any wetland type, an alphabetical listing is preferred over an attempt at listing species by importance value. The choice of associated species listed sometimes is arbitrary but, in the absence of complete species lists for each type, is inescapable. Profiles are provided for most wetland types. These diagrammatic depictions of vegetation structure are meant only to reinforce the textual material. The section on transition zones outlines the plants or plant communities characteristically found between adjacent wetland types or between wetlands and uplands. Such transitions may be abrupt but more often they are gradual. The generalized structure of each wetland type and its relationship to transition zones is indicated by a pictorial vegetation profile.

c. Physical environments. The environmental conditions, the characteristic water regimes, and soils of each wetland type are described where available. The discussions are limited to aspects of the physical environment most often affecting the vegetation and are not intended to fully describe the environment.

d. Field identification. The section on field identification gives the characteristics that distinguish the wetland type from other wetland types and from adjacent uplands.

19. In most cases some attempt to discuss successional relationships of wetland communities is made. In many cases, however, the successional relationships of wetlands vegetation are too poorly understood for meaningful generalizations.

20. The primary purpose of the guidebook series is to aid regulatory functions personnel in identifying wetland types. For that reason a well-organized but general approach has been attempted. The classification system in the guides is intended solely for implementation in the Section 404 permit program and is not considered a definitive classification system for other purposes.

Botanical Nomenclature

Common names

21. Common names, while admittedly convenient, often vary from

place to place. One species may have several names in different geographic regions, or the same name may be applied to unrelated species in different areas. Yet other species lack a common name. In the guidebook series, the common name used for a plant is the one, in the opinion of the author, most often used locally within the region. A single common name is used even though several names may be in use within the region. Those species not known to have a common name are referred to by their scientific name. Specific common names are here capitalized.

22. To assist in utility of the guides, an attempt has been made to provide a common name at each point where a scientific name appears. In a few cases, however, this has not been practical or has been considered superfluous; for that reason, in cases where assurance of communication seemed evident, a single name was employed.

Scientific names

23. Botanists, ecologists, and other scientists use scientific names in their technical publications and discussions. The Latin form of scientific names is definitive and uniformly adhered to by botanists around the world under the International Code of Botanical Nomenclature. Thus, the Latin name of a plant species is understood by the scientific community throughout the world, regardless of the prevailing language in a country.

24. Scientific names used in this guidebook series consist of two words. The first word of the scientific name is that of the genus to which a plant belongs, and it is always capitalized. The second word of the scientific name is referred to as the specific epithet, and it is printed here in lower case even though it may be derived from a geographical name or the name of a person. Both words are italicized or underlined. Following the scientific name it is customary, at least in checklists, to give the name of the author or person who originally described the plant to science; the name of the author is referred to as the authority. The authority for plants in these guides is given in Appendix A and in most cases the authority is abbreviated.

25. The following example illustrates the function and meaning of a typical scientific name. The genus *Typha* was first described by the

Swedish botanist Linnaeus, as was the Common cattail, which occurs over most of the United States. Its name, therefore, is written *Typha latifolia* L., indicating that this species was described by Linnaeus. The scientific name *latifolia* indicates that the plant has broad leaves, in this case an accurate description.

26. Occasionally, there is need to refer to an unidentified species of a particular genus; an unidentified species of *Potamogeton*, for example, would be referred to in the text as *Potamogeton* sp. Similarly, it is sometimes convenient to refer to a group of species of a particular genus without giving the complete scientific name of each. A group of species of the genus *Potamogeton* would be given as *Potamogeton* spp.

27. Within the text of a paragraph or more of material, it is considered redundant to repeat the complete scientific name repetitively after its initial use. The species *Potamogeton amplifolius* would be given in full where first mentioned but at later times might be referred to in the text as *P. amplifolius*, the *P.* being an abbreviated form of *Potamogeton*. In situations where confusion with other species might result, however, the scientific name is given in full.

Synonymy of scientific names

28. Many plant species have been given more than one scientific name in the course of botanical history. A species may have been described and named independently by different botanists, or two species may have been considered one and the same following a period of study. In addition, there are differences of opinion among professional botanists as to whether a variation merits recognition as a variety or as a separate species or perhaps needs no additional name.

29. Because of differences of interpretation, one will often find a particular plant referred to by different scientific names in two or more separate publications. For this reason each of the guidebooks in this series has been compiled with the use of a particular publication as a standard for botanical nomenclature. In each case the standard for botanical nomenclature is a well-known regional manual of plant identification. The standard for each guidebook is identified in the section entitled Regional Botanical References.

PART II: WETLANDS OF THE GULF COASTAL PLAIN

Regional Environment

30. The Gulf Coastal Plain region lies on the coastal plain and extends from Texas to western Georgia. The inland boundary on the east is the fall line where the Piedmont region meets the coastal plain. The region extends inland to southern Illinois (Cairo, Illinois) in the Mississippi Embayment. The latitudinal range is from approximately 26 degrees at the southern boundary to 37 degrees at Cairo. The area encompassed by this guide thus includes the eastern half of Texas (east of 98th meridian); the southeastern corner of Oklahoma; much of Arkansas; all of Louisiana, Mississippi, and Alabama; the southwestern corner of Georgia; and the northwestern panhandle of Florida.

31. The climate is maritime-temperate to subtropical and is marked by hot humid summers and mild winters. Snowfall is minimal to rare over most of the region. The annual rainfall averages 115 to 140 cm but reaches levels of approximately 165 cm along parts of the Louisiana coast. Precipitation gradually decreases westward along the coast, diminishing from 140 cm at the western Louisiana border to 61 cm at the southern tip of Texas. Distribution of precipitation is more or less even throughout the year. Droughts are rare, but they do occur; spring months tend to be the wettest. Thunderstorms with very heavy rainfall are common in the Gulf region. Hurricanes are occasional and probably average about one every five to eight years in most parts of the coastal area. The hurricanes rarely reach far inland, but they may cause high winds and heavy rains inland.

32. The Gulf Coastal Plain, like peninsular Florida, is geologically young and has been exposed above the ocean only since the beginning of the Cenozoic era about 70 million years ago. The Gulf coast up to about 200 km inland has been exposed only since the beginning of the Quaternary. Unlike peninsular Florida, however, the tropical affinities of the biota are minimal.

33. Soils vary from sand to silt and clay; peaty soils are uncommon but are known in the region. The Gulf coast subsided during the

Mesozoic and Cenozoic eras, but this was balanced by sediment deposition so that up to 9000 m of sediments have accumulated along parts of the Louisiana coast.

34. The regional vegetation consists largely of forest. Uplands are forested largely by a mixture of pines, oaks, magnolia, and beech, but few remnant stands remain. Bottomland hardwoods are extensive throughout the region and are harvested widely. The coastal salt marshes, dominated principally by cordgrasses (*Spartina* spp.) and Black rush (*Juncus roemerianus*), and the riparian forests probably are similar to those found when European man first arrived in the region.

Regional Botanical References

35. There is no single manual of plant identification that covers the entire Gulf Coastal Plain. For that reason selection of a single work to serve as a nomenclatural standard for all species mentioned in the guide was not possible. The work of Correll and Johnston (1970), however, includes the majority of species in the region and was chosen to serve as a primary standard for botanical nomenclature. This is to say that most scientific names employed in this guide are used in the sense of that publication. Choice of common names is arbitrary sometimes but generally is based on general usage within the region.

36. The publication of Correll and Correll (1972) is extremely useful in that part of the region west of the Mississippi River. It is well illustrated and specifically treats wetland species. Another technical work of great value in the Gulf Coastal Plain is Radford et al. (1968). It is particularly useful in the eastern part of the region, where occur most of the species not covered by Correll and Johnston (1970). Clark (1971) includes only woody plants but is another valuable work for identification of many wetland species in the portion of the region east of the Mississippi River.

37. Workers in the Mississippi Embayment region of northeastern Arkansas and southeastern Missouri will find the work of Steyermark (1963) useful. It is well illustrated, and the keys are written specifically for use by persons who are not botanists by profession.

38. A guide to the identification of wetland plants in the New Orleans District, CE, by Montz (in press) promises to be a valuable reference for the region. It is illustrated in color and treats a large number of wetland species.

39. Several nontechnical works pertaining to the region are best used for the identification of showy, large-flowered plants. Many of these works are of high quality but generally are of limited use in the identification of the numerous graminoids that are so important to the structure of many wetlands. Representative works in this category are those of Brown (1972) and Rickett (1967).

Wetland Types

List of wetland* types in the Gulf Coastal Plain

40. Of the nine possible wetland types, the Gulf Coastal Plain possesses eight. A brief definition of each type follows.

a. Saltwater aquatic. Wetlands that are dominated by free-floating, rooted, or otherwise attached herbaceous plants (including macroscopic marine algae) and are permanently flooded by saline or brackish water (e.g., seagrass beds).

b. Saltwater coastal flat. Wetlands that have 25 percent or less vegetative cover and are occasionally (shallow flat) or regularly (deep flat) flooded by saline water of tidal origin (e.g., nonvegetated intertidal zone).

c. Saltwater marsh. Wetlands that have more than 25 percent vegetative cover or herbaceous plants but 40 percent or less cover by woody plants and are occasionally or regularly flooded by brackish or saline water (e.g., smooth cordgrass marshes).

d. Saltwater swamp. Wetlands that have more than 40 percent cover by woody plants and are occasionally or regularly flooded by brackish or saline water (e.g., mangrove swamps).

e. Freshwater aquatic. Wetlands that are usually dominated by free-floating or rooted aquatic herbs and are semi-

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* See Appendix C for an interpretation of the definition of wetlands.

permanently or permanently flooded by fresh water (e.g., floating duckweed mats).

f. Freshwater flat. Wetlands that have 25 percent or less vegetative cover and are occasionally or regularly flooded by fresh water (e.g., mudflats).

g. Freshwater marsh. Wetlands that have more than 25 percent vegetative cover of herbaceous plants but 40 percent or less cover by woody plants, which are occasionally or regularly flooded by fresh water (e.g., cattail marsh).

h. Freshwater swamp. Wetlands that have more than 40 percent cover by woody plants and are occasionally or regularly flooded by fresh water (e.g., cypress swamps).

SALTWATER AQUATIC WETLANDS

Definition: Wetlands that are dominated by free-floating, rooted, or otherwise attached aquatic herbs and are permanently flooded by brackish or saline water

41. The saltwater aquatic community is distributed more or less continuously along the Gulf coast, largely below the intertidal zone. These areas commonly are called "seagrass beds." The seaward limit is apparently the limit of rooted plant growth, while the shoreward limit is approximately at the elevation of the lower mean tide; consequently, the plants are exposed above the water surface only during exceptionally low tides. These areas are used heavily by numerous sport and commercial fish and shellfish species, such as spotted sea trout and shrimp, as well as by numerous wading birds and shorebirds. Seagrass beds are used as food by many grazers such as sea urchins, manatees, turtles, and some fishes. The saltwater aquatic wetland is also of major importance in the detrital food chain and in nutrient cycling of the shallow coastal area.

VEGETATION

42. Growth forms and physiognomy: submerged, narrow-leaved herbs, such as Turtle grass, and algae; frequently in dense scattered or extensive stands.

43. Species composition of the saltwater aquatic wetland:

Dominant species

Halodule beaudettei (Shoal weed)
Ruppia maritima (Widgeon grass)
Thalassia testudinum (Turtle grass)

Associated species

Cymodocea filiformis (Manatee grass)
Halophila baillonis (Caribbean halophila)
Halophila engelmannii (Gulf halophila)

Dominant and associated species. Turtle grass (*Thalassia testudinum*) is the most abundant plant in the saltwater aquatic community and often occurs in dense stands by itself. It sometimes grows in deep water of 5 m or more, but usually turbidity limits the light penetration,

resulting in the usual restriction of Turtle grass to areas less than 3 m deep. Manatee grass (*Cymodocea filiformis*) sometimes is associated with Turtle grass, especially in the deeper areas; pure stands sometimes are found on sandy bottoms where currents are fairly swift. In contrast, Shoal weed (*Halodule beaudettei*) normally grows in shallow areas either intermixed with Turtle grass or alone. Shoal weed apparently can withstand the higher temperatures and occasional exposure to the drying conditions of the air better than can the other submerged species of the saltwater aquatic wetland. Widgeon grass (*Ruppia maritima*) also tolerates higher temperatures and occasional exposure to the air; it thrives in shallow areas, often extending into the intertidal zone and in shallow ponds bordered by Black mangrove (*Avicennia germinans*).

Although common, Gulf halophila (*Halophila engelmannii*) is inconspicuous in Turtle grass beds. Like Turtle grass (*Thalassia testudinum*), Gulf halophila apparently is limited by low light intensities, but it can grow in light that is too reduced for Turtle grass; Gulf halophila has been found in very deep waters of over 66 m in depth. Gulf halophila usually grows in the shade of Turtle grass, nearly to the shoreward limits of Turtle grass, but usually is difficult to discern. Caribbean halophila (*Halophila baillonis*) apparently grows in water equally as deep as does Gulf halophila and generally is found in water at least 4.5 m deep.

Successional trends. Relatively few long-term observations on seagrass succession have been made; a review of such information is given by den Hartog (1977). Turtle grass (*Thalassia testudinum*) represents the final stage in succession in the Gulf of Mexico, as well as in the Caribbean, and is of widespread occurrence. When the Turtle grass beds are disturbed by dredging, storms, or other factors, the empty spaces are replaced quickly by plants of *Halodule beaudettei* (den Hartog, 1977). Eventually the *Halodule* will be replaced by *Thalassia*. *Halodule* generally is thought to be a pioneer species that is not strongly competitive and is persistent only in habitats that are not favorable to other seagrass species. Similarly, *Halophila* spp. tend to dominate only on areas that are unsuitable for *Halodule*.

Transitional species. The saltwater aquatic community almost always borders other wetland types and rarely adjoins natural upland communities. The seaward limit of rooted plant growth is the outer boundary of the seagrass communities; the lower limit of the intertidal zone marks the approximate shoreward boundary. Widgeon grass (*Ruppia maritima*) can grow both above and below the lower intertidal

boundary, though the upper area is also often nonvegetated or has very sparse vegetative cover and is classed as a coastal flat wetland. Above this, the area may be a saltwater marsh or swamp.

ENVIRONMENTAL CONDITIONS

44. The substrate is highly variable, ranging from sandy soil to silt and clay. Where rivers empty into the Gulf, there are usually interruptions of the grass beds caused by influence of fresh water (and possibly turbidity). Beyond the influence of the fresh water, grass beds may be found despite the distance to the coast, which sometimes is a matter of several kilometres away. The shallowest areas are exposed to the air during low spring tides, and the leaves may be killed during these periods of exposure.

45. Patriquin (1972) demonstrated that *Thalassia* is restricted to reduced substrates while *Cymodocea* and *Halodule* prefer oxidized conditions. *Halodule*, therefore, is well adapted for growth and colonization on rapidly accreting and shifting substrates with coarse particle size, while *Thalassia* is associated with fine-grained sediments.

FIELD IDENTIFICATION

46. The saltwater aquatic community can be identified by its usual landscape position below the intertidal zone and by the dominance of submerged aquatic herbs.

SALTWATER COASTAL FLAT

Definition: Wetlands that have 25 percent or less vegetative cover and are occasionally or regularly flooded by saline water of tidal origin

47. Coastal flats primarily include nonvegetated or sparsely vegetated intertidal areas. They include hypersaline areas above the mean high tide that are inundated during storm tides and sparsely vegetated. Some coastal flats are slight depressions, flooded only at high tides, in which the water evaporates leaving the soils hypersaline; few plants can withstand these conditions. In the Gulf region, saltwater coastal flats are found intermittently along the entire coast but probably are most common along the Florida coast.

48. Saltwater coastal flats are largely nonvegetated or with only sparse vegetation cover, but the invertebrates that live in these flats and feed on organic materials (and other organisms) are extremely important in the diets of some fish and birds, such as sand pipers.

VEGETATION

49. Growth forms and physiognomy: The deep saltwater coastal flat (with frequent tidal inundation) is either nonvegetated or has scattered seagrasses tolerant of exposure on low tides; sometimes various floating and/or attached marine algae are found. Seagrasses, if present, frequently are very short and rarely exhibit the luxuriant growth forms found in the saltwater aquatic wetland. The shallow saltwater coastal flat (with infrequent tidal inundation) is either nonvegetated or has scattered succulent forbs, often Glassworts (*Salicornia virginica*), that are usually less than 0.7 m tall.

50. Species composition of the saltwater coastal flat wetland:

Dominant species

Batis maritima (Saltwort)
Salicornia virginica (Glasswort)

Associated species

Avicennia germinans (Black mangrove)
Cenchrus spp. (Sand-bur)
Philoxerus vermicularis (Beach carpet)

Spartina spartinae (Gulf cordgrass, Prickly cordgrass)
Suaeda linearis (Sea blite)

Dominant and associated species. Saltwater coastal flats in the intertidal zone commonly have few or no plants present. In depressions where storm tides are captured, the plant cover occasionally may be somewhat higher under local conditions, but usually hypersalinity precludes high cover value. The vegetation most often consists of Saltwort (*Batis maritima*) and Glasswort (*Salicornia virginica*), but the associated species listed above often are found in these areas either in combination or sometimes alone.

Transitional species. Saltwater coastal flats may be found adjacent to the ocean or the saltwater aquatic community or surrounded by salt marsh vegetation. Occasionally the flats are in contact with saltwater swamps dominated by *Avicennia*, although such swamps are usually depauperate in character. In most cases, the demarcation between adjacent vegetation types is distinct. Where saltwater coastal flats are adjacent to the ocean at their lower edges, the upper edges may be adjacent to strand vegetation, saltwater marsh, or saltwater swamp. Most often, however, commercial developments border saltwater coastal flats, and human activities have eliminated most of the flats in many areas.

ENVIRONMENTAL CONDITIONS

51. The soil of coastal flats usually is sandy and saline or, more rarely, hypersaline with salinities as high as 120 to 130 ppt. The hypersaline conditions result from evaporation of storm-tide water.

FIELD IDENTIFICATION

52. Coastal flats are recognized readily because they are above the lower mean tide level, and, if vegetated, the plants are not submerged aquatics. This distinguishes the flats from the saltwater aquatic community. Saltwater marshes and shallow coastal flats are distinguished best by their differences in cover value, because many species are common to both wetland types. The deep coastal flat (located in the lower intertidal zone) shares many species with the saltwater aquatic community, but the flat is identified by its sparse and/or stunted vegetation. The coastal flat is distinguished from the saltwater swamp by the absence of high cover value by woody plants in the flat.

SALTWATER MARSH

Definition: Wetlands that have more than 25 percent vegetative cover of herbaceous plants but 40 percent or less cover by woody plants and that are occasionally or regularly flooded by brackish or saline water

53. Salt marshes are scattered along the entire Gulf coast. Occasionally the marshes occur directly adjacent to the gulf, but often they are separated from the ocean by coastal flats. Marshes subject to salt water and tidal influences occur many miles inland in Louisiana. Saltwater marshes are extensive along the Gulf coast, but commercial, industrial, and residential developments have destroyed significant acreages.

54. Saltwater marshes are particularly extensive along the Louisiana coast, where they have been studied extensively by numerous workers. Chabreck, Joanen, and Palmisano (1968) prepared a map of the Louisiana coast on which they recognized three types of coastal marsh exhibiting saltwater influence: saline, brackish, and intermediate marshes. Most recent workers in the region, at least in Mississippi and Louisiana, have continued the practice of recognizing the three variations of saltwater marsh.

55. Saline marshes have high salinities and are marked by low species diversity. Brackish marshes have moderate salinities and are characterized by higher species diversity than saline marshes. The intermediate marshes are transitional between brackish and freshwater marshes and are marked by low salinities and high species diversity.

56. The cyclic catastrophic hurricane storm tides, along with a gradual rise in the general sea level, have resulted in saltwater intrusion and have been significant factors in the continual alteration of plant community patterns within the Gulf coast ecosystem. Storm tides also effect sediment displacement and formation of natural levees; these natural levees in turn alter hydrology and salinity regimes, thus contributing to the dynamic nature of these coastal systems. In addition to these and other natural phenomena, impacts of construction activities

and other perturbations in both saltwater and adjacent freshwater habitats are major factors of the ever-changing coastal scene.

57. Salt marshes are extremely valuable natural resources. Some of their principal values include very high productivity of both plants and animals, ability to prevent erosion, and capacity to assimilate large quantities of organic wastes.

VEGETATION

58. Growth forms and physiognomy: dense stands of graminoids, especially cordgrasses (*Spartina* spp.) and Black rush (*Juncus roemerianus*); to 3 m high; shrubs and forbs either scattered or occasionally in small, dense stands.

59. Species composition of the saltwater marsh:

a. Marsh with high salinities (saline marsh)

Dominant species

Avicennia germinans (Black mangrove)
Juncus roemerianus (Black rush)
Spartina alterniflora (Smooth cordgrass, Oystergrass)

Associated species

Agalinis maritima (Seaside gerardia)
Aster subulatus (Annual saltmarsh aster)
Aster tenuifolius (Perennial saltmarsh aster)
Batis maritima (Saltwort)
Borrichia frutescens (Sea oxeye)
Distichlis spicata (Saltgrass)
Fimbristylis castanea (Sand rush, Saltmarsh fimbristylis)
Halodule beaudettei (Shoalgrass)
Lythrum lineare (Saltmarsh loosestrife)
Salicornia spp. (Glasswort)
Scirpus maritimus (Leafy three-square)
Spartina patens (Saltmeadow cordgrass, Wiregrass)
Spartina spartinae (Gulf cordgrass, Prickly cordgrass)

b. Marshes with moderate salinities (brackish marsh)

Dominant species

Ruppia maritima (Widgeon grass)
Scirpus olneyi (Three-cornered grass)
Scirpus maritimus (Leafy three-square)
Spartina cynosuroides (Big cordgrass, Hogcane)
Spartina patens (Saltmeadow cordgrass, Wiregrass)

Associated species

Acnida cuspidata (Southern waterhemp, Belle-dame)
Agalinis maritima (Seaside gerardia)
Aster subulatus (Annual saltmarsh aster)
Aster tenuifolius (Perennial saltmarsh aster)
Bacopa monnieri (Water hyssop)
Bacopa rotundifolia (Roundleaf bacopa)
Batis maritima (Saltwort)
Borrichia frutescens (Sea oxeye)
Cyperus odoratus (Cyperus)
Distichlis spicata (Saltgrass)
Echinochloa walteri (Walter's millet)
Eleocharis cellulosa (Gulf spikerush)
Eleocharis equisetoides (Northern jointed spikerush)
Eleocharis parvula (Dwarf spikerush)
Fimbristylis castanea (Sand rush, Saltmarsh fimbristylis)
Heliotropium curassavicum (Seaside heliotrope)
Juncus roemerianus (Black rush)
Kosteletskya virginica (Pink hibiscus)
Leptochloa spp. (Sprangletop)
Ludwigia palustris (Marsh purslane)
Myriophyllum spp. (Watermilfoil)
Najas guadalupensis (Southern naiad)
Panicum virgatum (Switchgrass)
Paspalum vaginatum (Jointgrass)
Phragmites communis (Reed, Roseau)
Pluchea purpurascens (Saltmarsh pluchea)
Scirpus validus (Softstem bulrush)
Sesbania macrocarpa (Sesbania)
Spartina alterniflora (Smooth cordgrass, Oystergrass)
Spartina spartinae (Gulf cordgrass, Prickly cordgrass)
Vallisneria americana (Wild celery)
Vigna luteola (Deer pea)

c. Marsh with low salinities (intermediate marsh)

Dominant species

Cladium jamaicense (Sawgrass)
Echinochloa walteri (Walter's millet)
Phragmites communis (Reed, Roseau)
Sagittaria lancifolia (Bulltongue)
Scirpus californicus (Giant bulrush, Tule)
Spartina patens (Saltmeadow cordgrass, Wiregrass)
Typha spp. (Cattail)
Vigna luteola (Deer pea)

Associated species

Acnida cuspidata (Southern waterhemp, Belle-dame)
Agalinis maritima (Seaside gerardia)

Alternanthera philoxeroides (Alligator weed)
Aster subulatus (Annual saltmarsh aster)
Aster tenuifolius (Perennial saltmarsh aster)
Bacopa caroliniana (Carolina hyssop)
Bacopa monnieri (Water hyssop)
Bacopa rotundifolia (Roundleaf bacopa)
Cyperus articulatus (Cyperus)
Cyperus compressus (Cyperus)
Cyperus odoratus (Cyperus)
Distichlis spicata (Saltgrass)
Eleocharis cellulosa (Gulf spikerush)
Eleocharis equisetoides (Northern jointed spikerush)
Eleocharis parvula (Dwarf spikerush)
Fimbristylis castanea (Sand rush, Saltmarsh fimbristylis)
Heliotropium curassavicum (Seaside heliotrope)
Hibiscus lasiocarpus (Rose mallow)
Hydrocotyle ranunculoides (Pennywort)
Hydrocotyle umbellata (Pennywort)
Hymenocallis caroliniana (Spiderlily)
Kosteletskya virginica (Pink hibiscus)
Leersia spp. (Cutgrass)
Lemna spp. (Duckweed)
Leptochloa spp. (Sprangletop)
Ludwigia palustris (Marsh purslane)
Myriophyllum spp. (Watermilfoil)
Najas guadalupensis (Southern naiad)
Osmunda regalis (Royal fern)
Panicum hemitomon (Maidencane)
Panicum virgatum (Switchgrass)
Paspalum vaginatum (Jointgrass)
Pluchea purpurascens (Saltmarsh pluchea)
Potamogeton spp. (Pondweed)
Scirpus americanus (Freshwater three-square)
Scirpus olneyi (Three-cornered grass)
Scirpus maritimus (Leafy three-square)
Scirpus validus (Softstem bulrush)
Sesbania macrocarpa (Sesbania)
Setaria magna (Giant foxtail)
Solidago sempervirens (Goldenrod)
Spartina alterniflora (Smooth cordgrass, Oystergrass)
Spartina cynosuroides (Big cordgrass, Hogcane)
Spartina spartinae (Gulf cordgrass, Prickly cordgrass)
Vallisneria americana (Wild celery)

Dominant and associated species. The three types of saltwater marshes (saline, brackish, and intermediate) are not delineated sharply from each other, rather the marsh types reflect subtle reassortment of species assemblages across the salinity gradient and many species occur in more than one marsh type. Many species

also occur in freshwater marsh. Saltwater marshes are particularly dynamic systems in the Gulf Coastal Plain, with significant changes in structure and composition of vegetation often occurring from one year to the next. Elevation, drainage patterns, and various edaphic and biological factors, all interacting with salinity, help to shape coastal plant communities as well as the ecosystem as a whole. Due to periodic rearrangement within the mosaic of plant communities, no truly typical pattern exists, thus generalizations that will apply throughout the region, or even a part of it, cannot be made. The lists of dominant and associated species must be viewed as species of potential occurrence in the marsh types, because local conditions allow for widespread variation in the species composition in saltwater marsh communities.

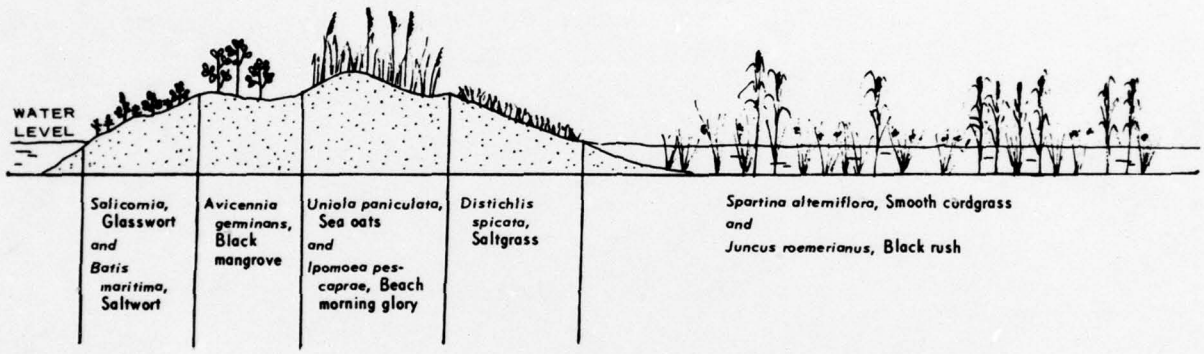

Figure 4. Transition from open sea to foredune to saltwater (saline) marsh

The reader is cautioned that the generalized floristic profiles contained within this guide are oversimplified and are not representative of many sites that will be found in the field. Wetland systems are dynamic, and many variations will be found. Species listed as "typical" on the profiles are those that generally occur as dominants in the particular wetland types. Those listed as "transitional" are those that regularly are associated with the transition zones at the margins of the individual wetland types. Associated species are those that are of common occurrence in a particular wetland type but generally are not sufficiently abundant to be dominants.

Saline marsh. Saline marsh is dominated by two species along most of the Gulf coast: Smooth cordgrass (*Spartina alterniflora*) and Black rush (*Juncus roemerianus*).

Black mangrove (*Avicennia germinans*) may be a dominant locally, particularly in Louisiana. Each of the three species usually grows in pure stands, although *Aster* spp. and other forb species occasionally are found intermixed. Smooth cordgrass and Black rush reach their best development (density, dry weight, and height) in the lower marsh where salinity values are high. Other associates are listed in the species list.

In small areas inundated only by storm tides, hypersaline conditions often result as salt accumulates following evaporation of storm-tide waters. Only a few species, such as Saltgrass (*Distichlis spicata*), Black rush (*Juncus roemerianus*), Glasswort (*Salicornia* spp.), and Sea blite (*Suaeda linearis*), may grow in such areas and vegetative cover may be less than 25 percent. When areas having hypersaline conditions cover a sizeable area, they should be considered saltwater coastal flats (WHICH SEE) rather than saltwater marsh, although there is little floristic difference between the two.

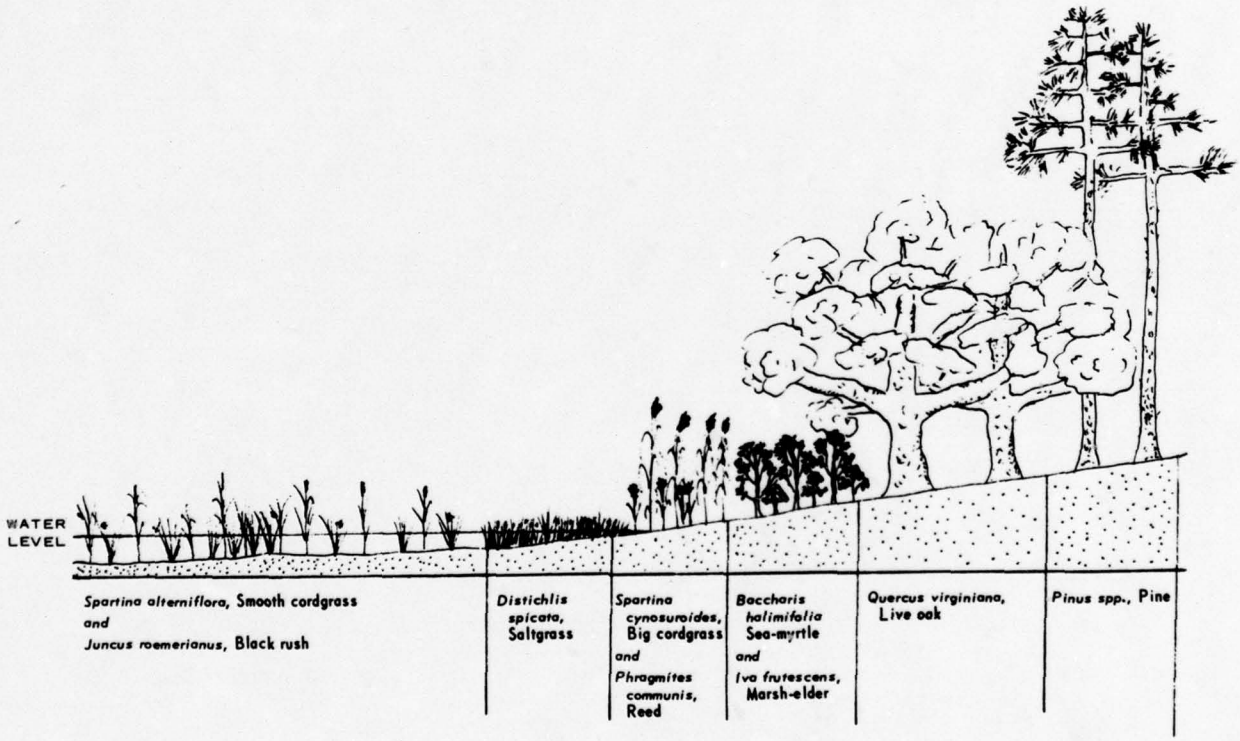

Figure 5. Transition from saltwater (saline, brackish, and intermediate) marsh into upland

Brackish marsh. The brackish marsh is marked by a reduction of both *Spartina alterniflora* and *Juncus roemerianus*. *Spartina alterniflora*, in fact, terminates in the brackish marsh and Black rush is marked by much smaller density values than in the saline marsh.

Spartina cynosuroides is a dominant in the brackish marsh, often intermixed with *Juncus roemerianus*. Other important species are *Scirpus olneyi* and *S. maritimus*, as well as *Spartina patens*. Species diversity is relatively high and includes many species that are more commonly found in other marsh types.

Intermediate marsh. This marsh variant includes an overlap of species from both brackish and freshwater marshes. Black rush is at its upper limit in the intermediate marsh and is of only minor importance. *Cladium jamaicense* is very important, often dominating large portions of the marsh. *Echinochloa walteri* and *Panicum virgatum* are common grass species of importance. *Phragmites communis* often grows in dense, pure stands on levees and other high areas in and around the marshes. *Vigna luteola* and *Scirpus californicus* are dominant species in Louisiana but are not of significance in the eastern portion of the region. Eleuterius (1972) reported that *Spartina patens, Spartina cynosuroides, Scirpus olneyi,* and *Scirpus maritimus* were absent from the intermediate marshes in Mississippi. Montz (1977a), however, said that *Spartina patens* may be a dominant species in Louisiana; likewise, he reported the occurrence of *Spartina cynosuroides, Scirpus olneyi,* and *Scirpus maritimus* in the intermediate marshes of that state.

Transitional species. Salt marshes usually are found on sites that are permanently or near permanently wet. Sometimes salt marshes occur behind sand dunes that are vegetated with succulents such as Glasswort (*Salicornia* spp.) and Saltwort (*Batis maritima*), grasses such as Sea oats (*Uniola paniculata*), and vines, often the Beach morning glory (*Ipomoea pes-caprae*). The salt marsh begins on the back side of the dunes with a zone of Saltgrass, followed by an area of Smooth cordgrass and Black rush.

The transition at the upper end of the marsh is either to another wetland type, usually a freshwater marsh, or to an upland vegetation type, usually a forest of some type. The ecotone between saltwater and freshwater marshes may be 0.3 to 2 m or more wide. Species commonly found in this transition zone include: Big cordgrass (*Spartina cynosuroides*), Reed (*Phragmites communis*), Joint grass (*Paspalum vaginatum*), Bulltongue (*Sagittaria lancifolia*), and Alligator weed (*Alternanthera philoxeroides*).

Big cordgrass, Reed, Sea myrtle (*Baccharis halimifolia*), and Marsh elder (*Iva frutescens*) frequently are found in

the transition zone between salt marshes and uplands. Often the *Baccharis* and *Iva* are sufficiently numerous to form a distinctive shrub-dominated transition zone.

ENVIRONMENTAL CONDITIONS

60. The most seaward salt marshes are inundated by all high tides, while the most landward stands may be flooded only during storms. A large percentage of salt marshes, however, have shallow standing water in all but the driest years. Soils found in salt marshes include peat, muck, dark brown clay, and various black and gray water-logged types.

61. Soil salinities in the saltwater marshes are highly variable, ranging from hypersaline to only slightly brackish. Chabreck (1970) reports the following salinity values for the Cheniere Plain of Louisiana: saline marsh (9.3-20.8 ppt), brackish marsh (1.0-9.6 ppt), and intermediate marsh (0.5-6.0 ppt). Hypersaline conditions (as high as 120 to 130 ppt) tend to occur where storm tides flood an area and salts accumulate in the soil as flood waters evaporate; such sites usually support a sparse vegetative cover that often is sufficiently low to classify the site as a saltwater coastal flat rather than a salt marsh. During the wet season the more inland brackish marshes may receive freshwater drainage from interior wetlands or uplands, but the soils of these marshes are sufficiently saline that the vegetation remains dominated by halophytes.

FIELD IDENTIFICATION

62. The dominance of cordgrasses or Black rush frequently is an easy way to identify saltwater marshes. This distinguishes them from freshwater marshes with which they would be confused most readily, because Black rush and the cordgrasses found in salt marshes usually are not important in freshwater marshes (except for Big cordgrass and Salt-meadow cordgrass, both of which may be significant in freshwater marshes).

63. Where Saltwort and other highly salt-tolerant species are found surrounded by typical marsh vegetation, the total vegetation cover should be examined closely. Salt marshes have more than 25 percent total cover, while the coastal flats have less than 25 percent total cover; otherwise their distinction is often arbitrary.

64. Salt marshes usually can be distinguished from adjacent uplands by physiognomy. Salt marshes have 40 percent or less cover by woody species, whereas most of the adjacent uplands are forested.

SALTWATER SWAMP

Definition: Wetlands that have more than 40 percent cover by woody plants and are occasionally or regularly flooded by brackish or saline water

65. The saltwater swamp wetland, which is dominated by mostly low-growing Black mangroves (*Avicennia germinans*), is of limited extent in the Gulf Coastal Plain. Black mangroves are scattered from Florida to Texas in the saltwater coastal flats and salt marshes, as well as in stands of sufficient cover to be considered swamp. The mangroves occur as fringe vegetation along the outer shoreline along the coast, as well as intermixed with graminoids in salt marshes. On the barrier islands, one finds extensive mangrove thickets, typically in association with *Spartina alterniflora*, on the sound side of the islands. Montz* estimates a total of approximately 1600 to 2400 ha covered by mangrove thickets along the Louisiana coast.

66. Mangrove stands, particularly on the barrier islands, play an important role in protection of the substrate against erosion by storm waters. In some areas, as on Isles Dernieres, the presence of large amounts of bird droppings on the ground and branches indicates heavy utilization of the mangrove areas; some of the thickets may serve as rookeries.

VEGETATION

67. Growth forms and physiognomy: moderate to dense growth of usually stunted, broadleaf evergreen shrubs, which sometimes show extensive pneumatophores; herbaceous plants, in the form of succulents or grasses, are common, particularly where the mangroves are of relatively low density.

68. Species composition of the saltwater swamp wetland:

Dominant species

Avicennia germinans (Black mangrove)
Spartina alterniflora (Smooth cordgrass, Oystergrass)

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* G. N. Montz, U. S. Army Engineer District, New Orleans, personal communication, March 1978.

Associated species

Batis maritima (Saltwort)
Borrichia frutescens (Sea daisy)
Distichlis spicata (Saltgrass)
Salicornia spp. (Glasswort)
Suaeda linearis (Sea blite)

Dominant and associated species. Black mangroves are the only woody plants found in the saltwater swamp. In an analysis of data from 107 1-m^2 quadrants on the Timbalier and Isles Dernieres barrier islands off the coast of Louisiana, Montz (1976a) found that Black mangrove had a frequency of 41.12 percent and an estimated cover value of 51 to 75 percent. Analysis of 20 10-m^2 quadrants in the vicinity of Trinity Bay, coastal Louisiana, revealed a total of 185 mangrove plants over 1 m in height and 1092 plants less than 1 m in height. Mangroves of the Gulf coast typically are stunted in size; Correll and Johnston (1970) report that the species is rarely over 1 m tall along the Texas coast. At some sites near the mouth of the Mississippi River in Louisiana, however, plants may reach heights of about 8 m. Montz (1976a) reported that mangroves on the Isles Dernieres were much larger than those observed on other barrier islands of the region, some plants in the center of the island reaching "15 to 20 feet {4.5 to 6 m}."

Common associates of Black mangrove include the following: Oystergrass, Saltwort, Sea ox-eye, Saltgrass, Glasswort, and Sea blite. Glasswort (*Salicornia* spp.) often is the only plant species present on extensive salty mudflats in the midst of the mangrove thickets.

Transitional species. The typical mangrove thicket of the Gulf coast intergrades completely with either saltwater marsh or saltwater coastal flat. The three wetland types share many species in common and are separated primarily on the basis of cover value (and, in the case of the swamp, on the basis of high cover value by woody plants). Transition zones, therefore, are designated rather arbitrarily.

ENVIRONMENTAL CONDITIONS

69. Saltwater swamps are found from slightly below the lowest tide levels to the limit of storm tides but are most common in the intertidal zone. Water and soil typically are brackish or saline. Mangrove stands often trap sediment and assist in preventing storm-tide erosion.

FIELD IDENTIFICATION

70. Saltwater swamps have more than 40 percent cover by woody plants, which distinguishes them from both the saltwater aquatic

community and salt marshes. In many areas, however, the borderline cover values and presence of many typical salt marsh species makes the distinction between salt marsh and saltwater swamp little less than arbitrary.

FRESHWATER AQUATIC WETLANDS

Definition: Wetlands that usually are dominated by free-floating or rooted aquatic herbs and are semipermanently or permanently flooded by fresh water

71. The freshwater aquatic community occurs in streams, rivers, canals, ponds, lakes, and reservoirs throughout the Gulf Coastal Plain. Often the community forms a narrow bank of vegetation that parallels shorelines, but many ponds, lakes, and canals are covered completely with vegetation. Sloughs and backwater areas of streams and rivers often support large tracts of freshwater aqautic vegetation. The freshwater aquatic wetland type in the Gulf coast region is of much significance; Montz (1975) cites a report of 8100 ha of submerged freshwater vegetation in Lake Pontchartrain alone.

72. Various aquatic plants are considered obnoxious weeds, reducing the recreational value of lakes and waterways, clogging irrigation canals and drainage ditches, and covering the water surface. Many of these aquatic weeds are aquarium-trade escapees or have been introduced in association with rice culture; although they are not native to the Gulf coast region, they thrive as if they were. The luxuriant growth of some of the aquatic plants is a response to the nutrient enrichment of the water by man's activities.

73. Some submerged aquatic plants form thick growths in lakes, ponds, drainage ditches, canals, streams, and slow-moving rivers. These plants often interfere with the passage of boats and hinder swimming and fishing. Among the least desirable of these species are the following introduced aquatics: Alligator weed (*Alternanthera philoxeroides*), Water hyacinth (*Eichhornia crassipes*), Elodea (*Elodea densa*), and Parrot's feather (*Myriophyllum brasiliense*).

74. Many freshwater aquatic communities are highly productive, both in primary and secondary productivity, and are extremely valuable as habitat for fish and wildlife. Montz (1975) reported that *Vallisneria* and other aquatics were grazed heavily by migratory waterfowl in Lake Pontchartrain.

VEGETATION

75. Growth forms and physiognomy: free-floating herbs, such as Water hyacinth, and rooted aquatic herbs, such as water-lilies and Widgeon grass; occurring in dense, sometimes scattered, stands; often with abundant masses of filamentous algae attached to vegetation or in detached floating clumps.

76. Species composition of the freshwater aquatic community:

Dominant species

Brasenia schreberi (Water shield)
Eichhornia crassipes (Water hyacinth)
Lemna spp. (Common duckweed)
Nuphar luteum (Spatterdock)
Nymphaea odorata (White water-lily)
Pontederia cordata (Pickerel weed)
Ruppia maritima (Widgeon grass)
Sagittaria latifolia (Common arrowhead)
Vallisneria americana (Wild celery)

Associated species

Alternanthera philoxeroides (Alligator weed)
Ceratophyllum demersum (Common hornwort, Coontail)
Hydrocotyle spp. (Water pennywort)
Myriophyllum brasiliense (Parrot's feather)
Najas guadalupensis (Southern naiad)
Potamogeton capillaceus (Snailseed pondweed)
Potamogeton diversifolius (Waterthread pondweed)
Sagittaria platyphylla (Delta arrowhead)
Sagittaria subulata (Dwarf arrowhead)
Spirodela polyrhiza (Duck-meat)
Utricularia spp. (Bladderwort)
Wolffia spp. (Watermeal)
Wolffiella spp. (Bog-mat)

Dominant and associated species. Freshwater aquatic communities may consist of admixtures of several dominant species along with several associated species, but frequently one or two species compose an entire dense stand of vegetation to the exclusion of other species. Usually the major species involved are those listed above as dominants, but some of the associated species are dominant under local conditions. Most of the species associated with the freshwater aquatic community are very widespread and intraregional differences are minor; there is likely to be as much difference in the vegetation of two ponds within a kilometre of each other as there is between a pond in southern Louisiana and one in northern Florida.

As ponds and lakes gradually fill in with sediments, the freshwater aquatic communities are replaced by marshes and ultimately by upland communities. Except where erosion is excessive, this process usually is slow and in large bodies of water may take hundreds of years for conversion to an upland situation.

Transitional species. Freshwater aquatic wetlands usually adjoin other wetland types, particularly freshwater marshes and freshwater swamps, as well as areas of open water having little or no vegetation. Many of the most abundant species of the freshwater aquatic wetland are common in adjacent wetland types; these species include Alligator weed (*Alternanthera philoxeroides*), Water hyacinth (*Eichhornia crassipes*), Common duckweed (*Lemna* spp.), bladderworts (*Utricularia* spp.), and Common arrowhead (*Sagittaria latifolia*). Relatively few of the dominant species of other wetland types, however, are common in freshwater aquatic communities, probably because few of them can withstand the low oxygen conditions of the aquatic environment.

Freshwater aquatic wetlands rarely border nonwetlands, although the intervening marsh or flat may be only a few metres wide, depending upon the local relief and land use.

ENVIRONMENTAL CONDITIONS

77. Most freshwater aquatic wetlands are inundated permanently except in drought years. Seasonally wet areas of herbaceous vegetation are classified as marshes since their vegetation is not dominated by floating or submerged aquatic plants; such areas often have less vegetative cover than more typical marshes in which inundation is for longer periods. Even in those ponds and lakes that experience significant water losses in drought years, the soils seldom dry out completely since the water table is at a very shallow depth; soils tend to remain permanently saturated even though the water level may be extremely low. Montz (1975) reported that loam soils, in general, tend to support submerged vegetation in Lake Pontchartrain, while clay and sand do not.

78. The environmental condition of open water, which often occurs in large portions of the aquatic freshwater system, refers simply to the water quality. Often the extent of the algal cover (that is, the surface mat of filamentous algae, if any) is dependent on the nutrient levels in water having heavy nutrient loads, especially of some forms of nitrogen and phosphorus. High levels of nutrients and organic materials

favor growth of surface algal mats as well as phytoplankton (small free-floating algae) and periphyton (algae attached to rocks and vegetable matter), but these effects are less conspicuous than the growth of algal mats on the surface. When these mats are formed, the algae of lower levels die, and the process of decomposition removes oxygen from the water and may cause anoxic conditions that result in the death of fish and other aquatic animals.

FIELD IDENTIFICATION

79. The freshwater aquatic community is dominated by herbaceous species, which distinguish it from freshwater swamp. The freshwater aquatic community is dominated by rooted and usually free-floating aquatic plants, which separates it from freshwater marshes having species such as Sawgrass, Cordgrass, and Cattail. Boundaries of this type may change rapidly as sediment accumulates, in which case the species composition changes, usually to a freshwater marsh. Simultaneously the outer limit, which is usually open water, may be extended as sediment accumulates and submerged plants invade this recently deposited soil.

80. Areas of open water in the freshwater aquatic system are recognized easily by the relative scarcity of vascular plants. The water may be nearly clear or may have dense algal mats. It should be pointed out that the various duckweed genera (*Lemna, Spirodela, Wolffia,* and *Wolffiella*) often coat the surfaces of open water (as well as water in the freshwater aquatic wetland as defined here); these tiny floating organisms often are moved across a body of water by wind or currents, resulting in their movement into areas that would not be considered wetlands on other bases. These species, therefore, should not be considered as constituting wetlands when growing to the total exclusion of other freshwater wetland species.

81. In some bodies of water, there may be many scattered dead trees that were killed by either disease or by changes in water levels; this situation often is found in the middle of a lake or pond that otherwise has vegetation belonging to typical freshwater aquatic communities. Such areas should be classified as freshwater aquatic wetland rather than as freshwater swamp.

FRESHWATER FLAT

Definition: Wetlands that have 25 percent or less vegetative cover and are occasionally or regularly flooded by fresh water

82. Freshwater flats are most common surrounding areas of fluctuating water levels, such as around reservoirs or adjacent to streams and rivers. These littoral areas are scattered throughout the Gulf Coastal Plain and, consequently, so are freshwater flats. These freshwater flats are heavily utilized by many species of shore birds.

VEGETATION

83. Growth forms and physiognomy: nonvegetated or vegetated with open stands of terrestrial herbs, such as Smartweed (*Polygonum*), and shrubs and trees, such as Willow (*Salix* spp.).

84. Species composition of the freshwater flat wetland:

Dominant species

Eragrostis hypnoides (Creeping lovegrass)
Gratiola virginiana (Hedge hyssop)
Hydrolea spp. (Waterleaf)
Ludwigia palustris (Marsh purslane)
Ludwigia peploides (Water primrose)
Polygonum spp. (Smartweed)
Salix spp. (Willow)
Scirpus cyperinus (Woolgrass)
Typha angustifolia (Narrowleaf cattail)
Typha latifolia (Narrow-leaved cattail)
Vitis palmata (Red grape)
A variety of additional species of sedges

Transitional species

Data not available

Dominant and associated species. The list of species that can be expected to occur on freshwater flats is diverse. There are pronounced differences in species composition on sites of differing substrate; the amount of shade also is significant. Generally speaking there is the potential for a greater species diversity on flats in the southern parts of the region as compared with those far inland.

Transitional species. Freshwater flats may adjoin areas of open water, freshwater marshes, or freshwater swamps. Gravel bars may be surrounded by open water, but shorelines usually meet open water or the freshwater aquatic wetland at their lower edges and marshes or swamps on the upper edge.

Where plants are present, the transition either to areas of open water or to the freshwater aquatic wetland is marked by changes in growth form: from terrestrial to aquatic herbs, or to mats or clotted clumps of largely filamentous algae. There is not necessarily a change in species composition from the freshwater flat to the marsh or swamp; instead there is a change in the percent cover of plants.

ENVIRONMENTAL CONDITIONS

85. Freshwater flats occur on all soil types, ranging from silty or even clayey to sandy and gravelly. Freshwater flats are a result of fluctuating water levels. Even at times when the fluctuations are reduced for a year or more, enough plants may invade a one-time flat that it gains enough vegetative cover to be classified a marsh; when the next floods occur and kill the plants, however, the site again becomes a flat.

FIELD IDENTIFICATION

86. Coastal flats are marked by their low cover value. Saltwater marshes and shallow coastal flats are best distinguished by their differences in cover value because many species are common to both wetland types. The deep coastal flat (with frequent tidal inundation) shares some species with the saltwater aquatic community, but the flat is identified by its sparse and/or stunted vegetation. The coastal flat is distinguished from the saltwater swamp by the absence of high cover value by woody plants in the flat.

FRESHWATER MARSH

Definition: Wetlands that have more than 25 percent vegetative cover of herbaceous plants but 40 percent or less cover by woody plants and that are occasionally or regularly flooded by fresh water

87. Freshwater marshes typically are found on gently sloping, low-lying ground of the coastal plain further inland than brackish or salt marshes. Since brackish marshes may be found up to 30 km inland from the actual coastline, the most extensive freshwater marshes are found at some distance from the coast. Generally the freshwater marsh is found on low flat areas associated with drainage systems of rivers and other streams. The water levels of some freshwater marshes located in coastal areas are influenced by tidal movements, but the fluctuations caused by tides seem to have little effect on the marsh vegetation.

88. Marshes often occur on floodplains, often where swamps have been cleared. This type of freshwater marsh is often referred to as a "wet meadow" and usually is dominated by species different from those of the typical coastal plain freshwater marsh. Species diversity in some of the wet meadows, particularly in the outer coastal plain, is extremely high and marked by a number of colorful and otherwise interesting forb species; consequently, wet meadows are discussed separately from the typical freshwater marsh. Wet meadows are sufficiently similar to other marshes in growth form, physiognomy, and floristics to justify their inclusion with freshwater marshes in general.

89. Values of freshwater marshes often depend on the degree of species diversity associated with a particular marsh, the amount of open water or variety of wetland types found in close association with the marsh, and the presence or absence of particular food-producing capacity for both plant and animal species; generally speaking, fish and wildlife values are enhanced when plant diversity is high and open water areas are extensive within the marsh proper.

VEGETATION

90. Growth forms and physiognomy: dense stands of graminoids, such as Sawgrass and Maidencane; with forbs, such as Bulltongue, either scattered or in small dense stands.

91. Species composition of the freshwater marsh:

a. Typical freshwater marsh of outer coastal plain

Dominant species

Alternanthera philoxeroides (Alligator weed)
Cladium jamaicense (Sawgrass)
Eleocharis cellulosa (Gulf spikerush)
Eleocharis equisetoides (Northern jointed spikerush)
Eleocharis parvula (Dwarf spikerush)
Panicum hemitomon (Maidencane)
Panicum virgatum (Switch grass)
Sagittaria lancifolia (Bulltongue)

Associated species

Acnida cuspidata (Southern waterhemp, Belle-dame)
Aster subulatus (Annual saltmarsh aster)
Aster tenuifolius (Perennial saltmarsh aster)
Azolla caroliniana (Mosquito fern)
Bacopa spp. (Water hyssop)
Bidens laevis (Sticktight)
Brasenia schreberi (Water shield)
Cabomba caroliniana (Cabomba)
Carex hyalinolepis (Caric-sedge)
Ceratophyllum demersum (Common hornwort, Coontail)
Colocasia antiquorum (Elephant's ear), in Louisiana
Cyperus spp. (Cyperus)
Distichlis spicata (Saltgrass)
Echinochloa walteri (Walter's millet)
Eichhornia crassipes (Water hyacinth)
Erianthus giganteus (Sugarcane plumegrass)
Hibiscus lasiocarpus (Rose mallow)
Hydrocotyle spp. (Pennywort)
Hymenocallis caroliniana (Spiderlily)
Iris spp. (Flag)
Juncus effusus (Soft sedge)
Kosteletskya virginica (Pink hibiscus)
Leersia spp. (Cutgrass)
Lemna spp. (Duckweed)
Leptochloa spp. (Sprangletop)
Limnobium spongia (Frog's bit)
Ludwigia spp. (Seedbox)
Mikania scandens (Climbing hemp)
Myriophyllum spp. (Watermilfoil)
Najas guadalupensis (Southern naiad)
Nelumbo lutea (American lotus)

Nuphar luteum (Spatterdock)
Nymphaea odorata (White water lily)
Nymphoides aquatica (Floating heart)
Osmunda regalis (Royal fern)
Ottelia alismoides (Duck lettuce), in Louisiana
Paspalum spp. (Paspalum grass)
Phragmites communis (Reed)
Pistia stratiotes (Water lettuce)
Pluchea purpurascens (Saltmarsh pluchea)
Polygonum spp. (Smartweed)
Pontederia cordata (Pickerel weed)
Potamogeton spp. (Pondweed)
Sacciolepis striata (Bag-scale)
Saururus cernuus (Lizard's tail)
Scirpus spp. (Bulrush)
Setaria magna (Giant foxtail)
Spartina cynosuroides (Big cordgrass, Hogcane)
Spartina patens (Saltmeadow cordgrass, Wiregrass)
Spirodela spp. (Duck-meat)
Thelypteris palustris (Southern marsh fern)
Typha spp. (Cattail)
Utricularia spp. (Bladderwort)
Vigna luteola (Deer pea)
Wolffia spp. (Watermeal)
Wolffiella spp. (Bog-mat)
Woodwardia virginica (Virginia chain fern)
Zizaniopsis miliacea (Southern wild rice)

b. Wet meadow of outer coastal plain

Dominant species

Carex spp. (Caric-sedge)
Cyperus spp. (Cyperus)
Eleocharis spp. (Spikerush)
Juncus effusus (Soft sedge)
Leersia oryzoides (Rice cutgrass)
Polygonum spp. (Smartweed)
Rhynchospora spp. (Beaked sedge)
Sagittaria latifolia (Common arrowhead)
Sagittaria platyphylla (Delta arrowhead)
Scirpus cyperinus (Woolgrass)
Typha spp. (Cattail)

Associated species

Aletris aurea (Yellow stargrass)
Callitriche heterophylla (Water starwort)
Calopogon pulchellus (Grass-pink)
Drosera spp. (Sundew)
Eriocaulon spp. (Pipewort)
Gratiola virginiana (Hedge hyssop)
Habenaria spp. (Bog-orchid)
Hydrocotyle spp. (Pennywort)

Juncus spp. (Rush)
Lachnocaulon anceps (Bog-button)
Lycopodium spp. (Clubmoss)
Osmunda cinnamomea (Cinnamon fern)
Osmunda regalis (Royal fern)
Pinguicula spp. (Butterwort)
Polygala spp. (Milkwort)
Sarracenia spp. (Pitcher plant)
Spiranthes spp. (Ladies'-tresses)
Utricularia spp. (Bladderwort)
Xyris spp. (Yellow-eyed grass)

c. Inland (interior) freshwater marsh (potential dominant and associated species)

Agrostis stolonifera (Redtop), in fresh meadow mainly
Alisma subcordatum (Water plantain), in deep marsh
Aster dumosus (Aster), in shallow marsh
Aster lateriflorus (Aster), in shallow marsh
Aster vimineus (Aster), in shallow marsh
Bidens polylepis (Stick-tight), in shallow marsh
Carex crinita (Caric-sedge), in deep marsh
Carex hyalinolepis (Caric-sedge), in all types
Carex lupulina (Caric-sedge), in deep marsh
Carex vulpinoidea (Caric-sedge), in deep marsh mainly
Cephalanthus occidentalis (Buttonbush)
Ceratophyllum spp. (Coontail), in deep marsh
Cyperus erythrorhizos (Red-root cyperus), in shallow marsh
Cyperus ferruginescens (Cyperus), in deep marsh
Cyperus strigosus (Cyperus), in shallow marsh
Echinochloa crus-galli (Barnyard grass), in shallow marsh
Eupatorium perfoliatum (Boneset), in shallow marsh
Eupatorium purpureum (Joe-pye weed), in shallow marsh
Eupatorium serotinum (Late boneset), in shallow marsh
Glyceria spp. (Manna grass), in fresh meadow
Juncus effusus (Soft sedge), in all types
Nuphar luteum (Spatterdock), in deep marsh
Panicum virgatum (Switch grass), in fresh meadow
Paspalum setaceum (Paspalum grass), in fresh meadow
Polygonum spp. (Smartweed), in shallow marsh
Pontederia cordata (Pickerel weed), in deep marsh
Sagittaria latifolia (Common arrowhead), in deep marsh
Scirpus atrovirens (Bulrush), in fresh meadow
Scirpus lineatus (Bulrush), in shallow marsh
Scirpus validus (Softstem bulrush), in deep marsh
Solidago spp. (Goldenrod), in shallow marsh
Stachys tenuifolia (Hedge-nettle), in fresh meadow
Teucrium canadense (Germander), in fresh meadow
Typha spp. (Cattail), in deep marsh

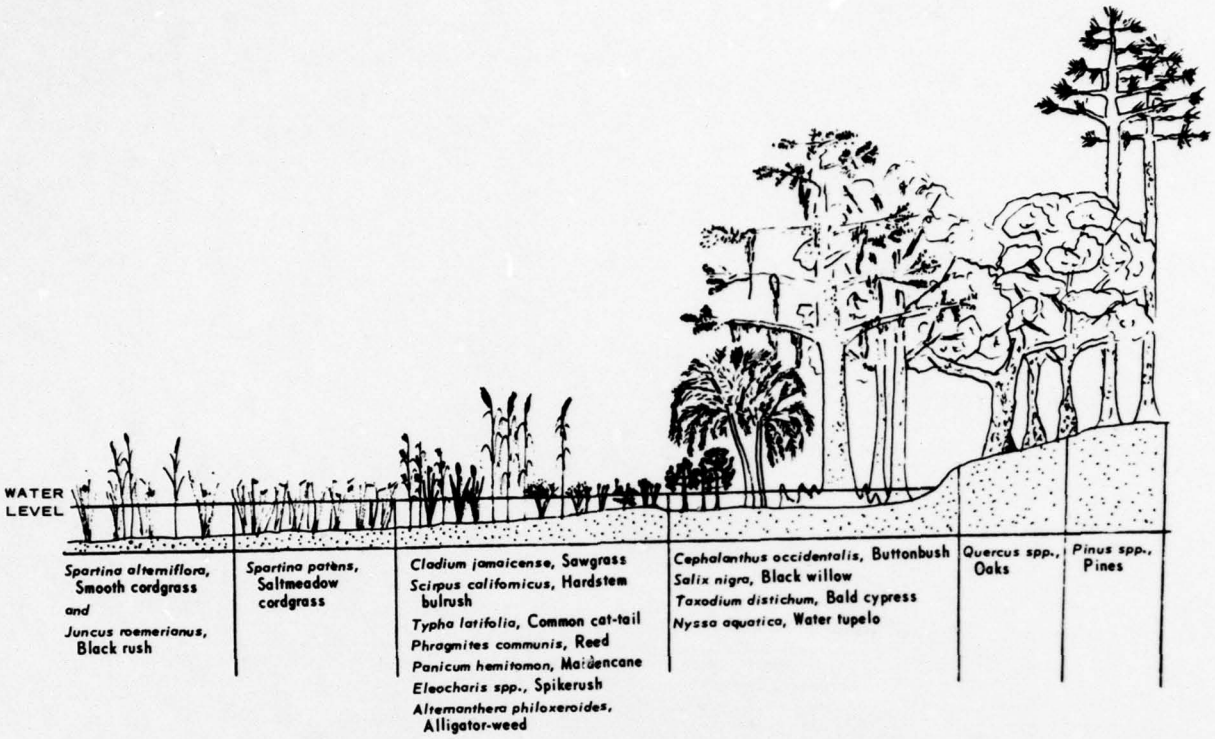

Figure 6. Transition from saltwater marsh through freshwater marsh to swamp, bottomland hardwoods, and into upland

Typical freshwater marsh of outer coastal plain. The freshwater marsh of the outer coastal plain typically occurs in close proximity to marsh having saltwater influence. The list of potential dominant and associated species of freshwater marshes is lengthy, and generalizations are difficult. Many freshwater marshes are dominated strongly by a single species and only scattered individuals of other species occur; others have small stands of single species scattered in a larger area dominated by one or a few species. The strong dominance by single species results from vegetative reproduction by rhizomes (underground stems) of many of the dominant species. Changes in microtopography probably explain the patchy patterns of isolated stands of species in an area dominated by another.

Water depth plays an important role in determination of which species may be dominant. Montz (1977a) described a deep water marsh in Louisiana in which the dominants were Bulltongue (*Sagittaria falcata*), Maidencane (*Panicum hemitomon*), Alligatorweed (*Alternanthera philoxeroides*), Water shield (*Brasenia schreberi*), Water hyacinth (*Eichhornia crassipes*), Frogbit (*Limnobium spongia*), and Bagscale (*Sacchiolepis striata*).

Another marsh, of the wet pasture type, was described by Montz as dominated by an entirely different species assemblage. Saltmeadow cordgrass (*Spartina patens*) was a dominant, along with Bulltongue, Sawgrass (*Cladium jamaicense*), Cattail (*Typha* spp.), Spikerush (*Eleocharis* spp.), Goldenrod (*Solidago sempervirens*), Climbing hemp (*Mikania scandens*), and Big cordgrass (*Spartina cynosuroides*).

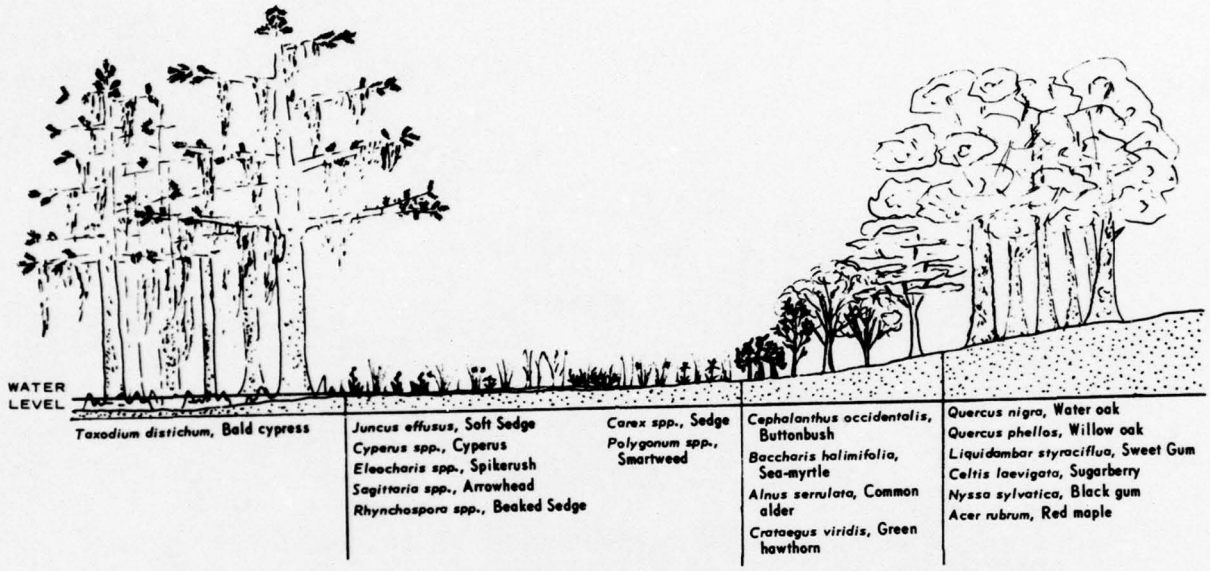

Figure 7. Transition from swamp to wet meadow into bottomland hardwoods

Wet meadows of lower coastal plain. The wet meadows of the lower coastal plain in part correspond to the wet savannahs of some authors; other authors refer to them as sedge meadows (at least in large part). These southern wet meadows normally are moderately to quite acidic in soil reaction, often associated with a natural seepage, and normally have a fluctuating water table. Typically they are associated with open flat pinelands and often with the product of either burning or cutting or both. These meadows are particularly well developed in the panhandle region of northern Florida, in the southernmost counties of Mississippi and Alabama, and in Vernon, Beauregard, and Saint Tammany parishes in Louisiana; a similar habitat occurs in parts of east and southeast Texas, although species diversity probably is not as high there as in the eastern parts of the region.

Species diversity of the southern wet meadows is extremely high in general, and it is very difficult to select a list of dominants. The cover value of graminoid

species is high in wet meadows, but in addition there are many species of colorful and otherwise interesting forbs present. The list of species to be expected includes several orchids (*Habenaria* spp., *Calopogon pulchellus*, *Spiranthes* spp.), pipeworts (*Eriocaulon* spp.), Bog-button (*Lachnocaulon anceps*), Yellow star-grass (*Aletris aurea*), Yellow-eyed grass (*Xyris* spp.), meadow beauties of several species (*Rhexia* spp.), milk-worts (*Polygala* spp.), and seedboxes (*Ludwigia* spp.) and numerous species of graminoids that are restricted to this type of wetland. Other noteworthy species of common occurrence in the wet meadows are clubmosses (*Lycopodium* spp.) and several kinds of insectivorous plants (*Sarracenia* spp., *Drosera* spp., etc.)

Several of the species associated with wet meadows are of great interest because of their insect-catching capabilities. The sundews and butterworts are known for their abilities to catch insects on the sticky leaf surfaces, while the pitcher-plants snare insects in hollow tubular leaves that partially fill up with digestive enzyme-containing liquid; in both cases, the insects are digested and the resulting nutrients are absorbed across the cells into the interiors of the plant's tissues. The presence of these interesting insectivorous plants, along with the wide diversity of colorful flowering forb species, often is sufficient for recognition of these interesting wetlands.

Wet meadows of northeastern Texas, southeastern Oklahoma, southern Arkansas, northern Louisiana, northern Mississippi, and northern Alabama primarily occur in close association with riparian systems. The vegetation is variable and different localities tend to support different dominants. Some of the more important plants that often occur as dominants include *Juncus effusus*, *Carex* spp., *Cyperus* spp., *Eleocharis* spp., *Scirpus* spp., *Rhynchospora* spp., *Leersia* spp., *Typha* spp., and *Polygonum* spp. Associated species may include any of the following in addition to numerous other species: *Hibiscus* spp., *Hydrocotyle* spp., *Hymenocallis* spp., *Ludwigia* spp., *Rumex verticillatus*, *Ranunculus pusillus*, *Ranunculus sceleratus*, *Ranunculus sardous*, *Saururus cernuus*, and *Bidens* spp., as well as numerous graminoids.

Inland (interior) freshwater marshes. Freshwater marshes in interior portions of the region, particularly in the northern portions of the Mississippi Embayment, are highly variable and have many species different from marshes in the southern part of the region. Sites characterized by the apparent absence of standing water

but marked by saturated soils often are referred to as "fresh meadows." The fresh meadow is the driest of all freshwater marsh variants. Such meadows develop in shallow lakes or in shallow sloughs as they begin to trap sediment. These marshes are dominated by clump-forming grasses, sedges, and rushes, although many other kinds of plants also are present. Woody plants typically are absent or present only in small numbers.

Freshwater marshes characterized by shallow water (up to 0.3 m deep) that stands throughout much of the year are common in the inland portions of the region. These marshes often dry out for a portion of the summer, although the water table is seldom far from the surface. Scattered woody plants may occur, but the dominants are relatively large, coarse, clump-forming herbs and graminoids.

Sites characterized by relatively deep water that stands for much of the growing season are common, particularly in low-lying areas. Water on such sites may be as much of 1 m in depth. Dominant plants are clump-forming sedges, cattails, Pickerel weed, and numerous other herbs. Persistent open water often supports floating and/or rooted aquatic species. Shrubs often are found, although cover value by woody plants must be less than 40 percent for the site to be recognized as a freshwater marsh; Buttonbush (*Cephalanthus occidentalis*) is a common plant of freshwater marshes. Other woody plants of importance are Willows (*Salix* spp.) and *Styrax americana*.

Transitional species. Although the transition may be the result of minor changes in elevations, the boundary between freshwater marshes and more upland communities often is well defined and marked by the presence of numerous woody species. Particularly where a freshwater marsh adjoins a freshwater swamp of Water tupelo-swamp black gum (*Nyssa aquatica-N. sylvatica* var. *biflora*) or Bald cypress-Water tupelo (*Taxodium distichum-Nyssa aquatica*), a zone of willows (*Salix* spp.), Buttonbush (*Cephalanthus occidentalis*), and sometimes *Styrax americana* often serves to separate the two wetland types.

Wet meadows often have been derived through alteration of one of the various swamp associations and may be contiguous with such woody assemblages. A sharp increase in elevation around a wet meadow often results in an abrupt transition into a first-bottom hardwood forest containing such species as Water oak, Willow oak, Sweet gum, Black gum, Winged elm, Sugarberry, Red maple, and Ironwood. Many of these woody species tolerate at

least some inundation, and an examination of local conditions will be necessary to determine whether the transition zone actually is a wetland or truly an intermediate transition zone. Delineation of freshwater marshes in flat pinelands often is difficult.

A shrub zone frequently separates a wet meadow from hardwood forest on sites where a slight slope occurs. The shrub species of such transitional zones vary from locality to locality. Especially common adjacent to wet meadows in the southern parts of the region are Yaupon (*Ilex vomitoria*), Fetterbush (*Lyonia lucida*), Inkberry (*Ilex glabra*), and Wax myrtle (*Myrica heterophylla*). Outside the lower coastal plain, some of the above species may be present, but more commonly will be found such things as Smooth alder (*Alnus serrulata*), Possum-haw (*Ilex decidua*), Groundsel (*Baccharis halimifolia*), and, in especially wet areas, Swamp privet (*Forestiera acuminata*).

Successional trends. Many of the wet meadows are derived from swamps that have been cleared. If the cutting or burning of these areas is maintained, wet meadow will prevail. If, however, these practices are discontinued, the successional trend will be in the direction of a return to the swamp condition. Siltation of marshes may be a factor in their conversion to upland habitats. Many marshes contain a shallow water cover, and any degree of silting may create a less saturated topsoil that would allow the invasion of more upland species.

ENVIRONMENTAL CONDITIONS

92. Freshwater marshes may be semipermanently flooded with several metres of water, or they may be only seasonally flooded. Water level fluctuations range from slight to large even in semipermanently flooded areas. The dominant growth form is related to the depth and duration of inundation with forbs dominating permanently wet areas and graminoids dominating seasonally wet sites. This does not always hold true. Cattail, for example, is generally considered a graminoid in ecological sampling but usually occurs in permanently wet areas. Salinity levels in freshwater marshes of the Gulf Coastal Plain obviously are low, typically ranging from 0 to 2 ppt.

FIELD IDENTIFICATION

93. The freshwater marsh is distinguished from the adjacent freshwater aquatic community by the change from rooted and free-floating

aquatic plants, such as Pickerelweed (*Pontederia*) and Water lily (*Nymphaea*), to nonaquatic ones. Separation from salt marshes must be based on quantitative studies of species composition, since many species are found in both marsh types. Several of the dominant freshwater marsh species, notably Sawgrass (*Cladium*), cattails (*Typha*), Reed (*Phragmites communis*), and Saltmeadow cordgrass (*Spartina patens*), also tolerate brackish water, making the boundary between these two wetland types difficult to ascertain under some conditions. Use of quantitative sampling techniques to examine the total species composition often will be required to establish this boundary.

FRESHWATER SWAMP

Definition: Wetlands that have more than 40 percent cover by woody plants and are occasionally or regularly flooded by fresh water

94. Freshwater swamps are extensive in the region and are associated with either low flatlands flooded by groundwater or with riparian habitats that are seasonally flooded when rivers and streams overflow their banks. Tidal movements affect the water level in some of these swamps, but the fluctuations are small and apparently have little effect on the vegetation.

95. Elevational gradients are low throughout the region, and the resulting extended moisture gradient is associated with a wide spectrum of habitat variations. Some swamps are flooded for extended periods of time, permanently or near permanently in some cases, while others are flooded on a cyclic basis but for much shorter time periods.

96. Freshwater swamps provide valuable land cover and serve as habitat for numerous species of fish and wildlife. Various portions of the freshwater swamp complex have been logged extensively for many years. Commercial logging currently is minor in the deeper, more permanently flooded swamps, but logging activities remain extensive in the bottomland hardwoods that dry out seasonally. Agricultural operations have resulted in the loss of extensive bottomland hardwoods tracts.

VEGETATION

97. Growth forms and physiognomy: medium to dense stands of tall, deciduous needleleaf trees, Bald cypress or Pond cypress, and deciduous broadleaf trees, such as Water tupelo; an understory of few to many shrubs, vines, and herbs; occasionally dominated by shrubs and small trees.

98. Species composition of the freshwater swamp wetland:

a. Swamps with standing water on permanent or semipermanent basis:

Dominant species

Acer rubrum (Red maple)

Cephalanthus occidentalis (Buttonbush)
Forestiera acuminata (Swamp privet)
Fraxinus caroliniana (Water ash)
Fraxinus profunda (Pumpkin ash)
Itea virginica (Virginia willow)
Nyssa aquatica (Water tupelo)
Nyssa sylvatica var. *biflora* (Swamp black gum)
Planera aquatica (Water elm)
Taxodium ascendens (Pond cypress)
Taxodium distichum (Bald cypress)

Associated species

Bidens spp. (Stick-tight)
Boehmeria cylindrica (False nettle)
Hydrocotyle spp. (Pennywort)
Hypericum walteri (St. John's wort)
Lemna spp. (Duckweed)
Myriophyllum spp. (Watermilfoil)
Nuphar luteum (Spatterdock)
Polygonum spp. (Smartweed)
Polypodium polypodioides (Resurrection fern)
Pontederia cordata (Pickerel weed)
Proserpinaca spp. (Water mermaid weed)
Saururus cernuus (Lizard's tail)
Sparganium americanum (Bur-reed)
Spirodela spp. (Duck-meat)
Wolffia spp. (Water meal)
Wolffiella spp. (Bog-mat)

b. Swamps with standing water for periods of a few days to several months:

Dominant species

Acer negundo (Box elder)
Acer rubrum (Red maple)
Betula nigra (River birch)
Carpinus caroliniana (Ironwood, Blue beech)
Carya aquatica (Water hickory)
Celtis laevigata (Sugarberry)
Cephalanthus occidentalis (Buttonbush)
Chamaecyparis thyoides (Southern white cedar)
Clethra alnifolia (Pepperbush)
Crataegus opaca (Mayhaw)
Crataegus viridis (Green hawthorn)
Decumaria barbara (Climbing hydrangea)
Diospyros virginiana (Persimmon)
Forestiera acuminata (Swamp privet)
Fraxinus caroliniana (Water ash)
Fraxinus pennsylvanica (Green ash)
Fraxinus profunda (Pumpkin ash)
Gleditsia aquatica (Water locust)

Ilex opaca (American holly)
Itea virginica (Virginia willow)
Liquidambar styraciflua (Sweetgum)
Magnolia virginiana (Bay magnolia, White bay)
Nuphar luteum (Spatterdock)
Nyssa aquatica (Water tupelo)
Nyssa sylvatica (Black gum)
Nyssa sylvatica var. *biflora* (Swamp black gum)
Persea palustris (Swamp bay)
Pinus serotina (Pond pine)
Pinus taeda (Loblolly pine)
Planera aquatica (Water elm)
Populus deltoides (Eastern cottonwood)
Populus heterophylla (Swamp cottonwood)
Quercus falcata var. *pagodaefolia* (Cherrybark oak)
Quercus laurifolia (Laurel oak)
Quercus lyrata (Overcup oak)
Quercus nigra (Water oak)
Quercus nuttallii (Nuttall's oak)
Quercus phellos (Willow oak)
Quercus stellata var. *mississippiensis* (Delta post oak)
Salix nigra (Black willow)
Taxodium ascendens (Pond cypress)
Taxodium distichum (Bald cypress)

Associated species

Bidens spp. (Stick-tight)
Boehmeria cylindrica (False nettle)
Hydrocotyle spp. (Pennywort)
Hypericum walteri (St. John's wort)
Lemna spp. (Duckweed)
Leersia oryzoides (Rice cutgrass)
Nuphar luteum (Spatterdock)
Polypodium polypodioides (Resurrection fern)
Pontederia cordata (Pickerel weed)
Saururus cernuus (Lizard's tail)
Sparganium americanum (Bur-reed)
Spirodela spp. (Duck-meat)
Ulmus alata (Winged elm)
Ulmus americana (American elm)
Zizaniopsis miliacea (Southern wildrice)

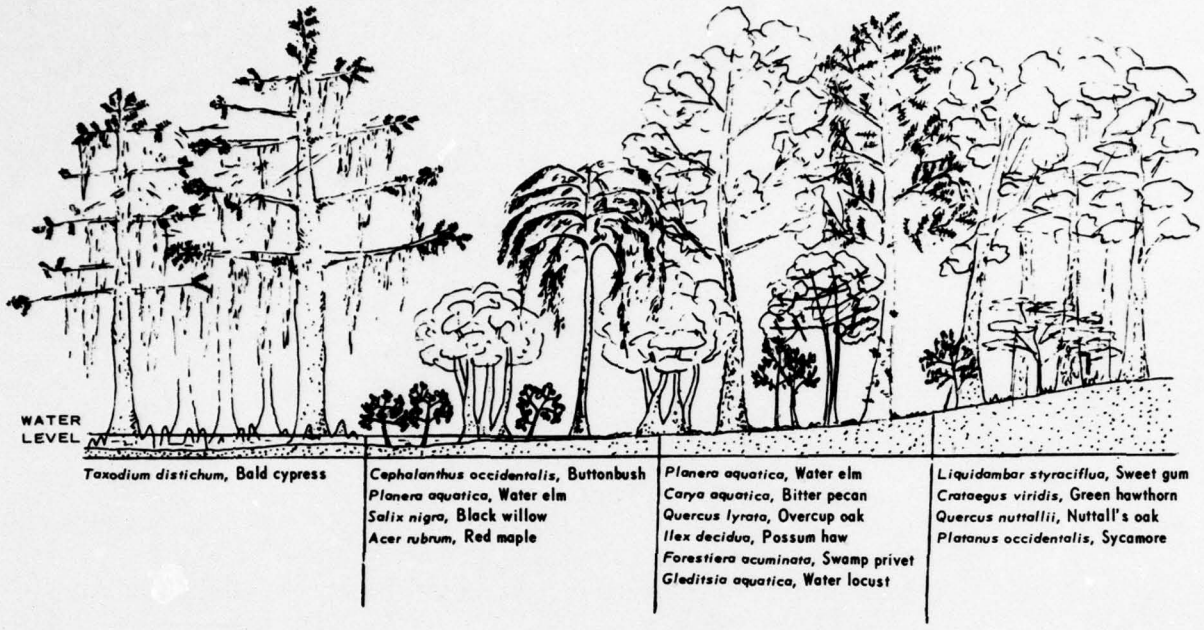

Figure 8. Transition from swamp through bottomland hardwoods complex in the northern portion of the study area

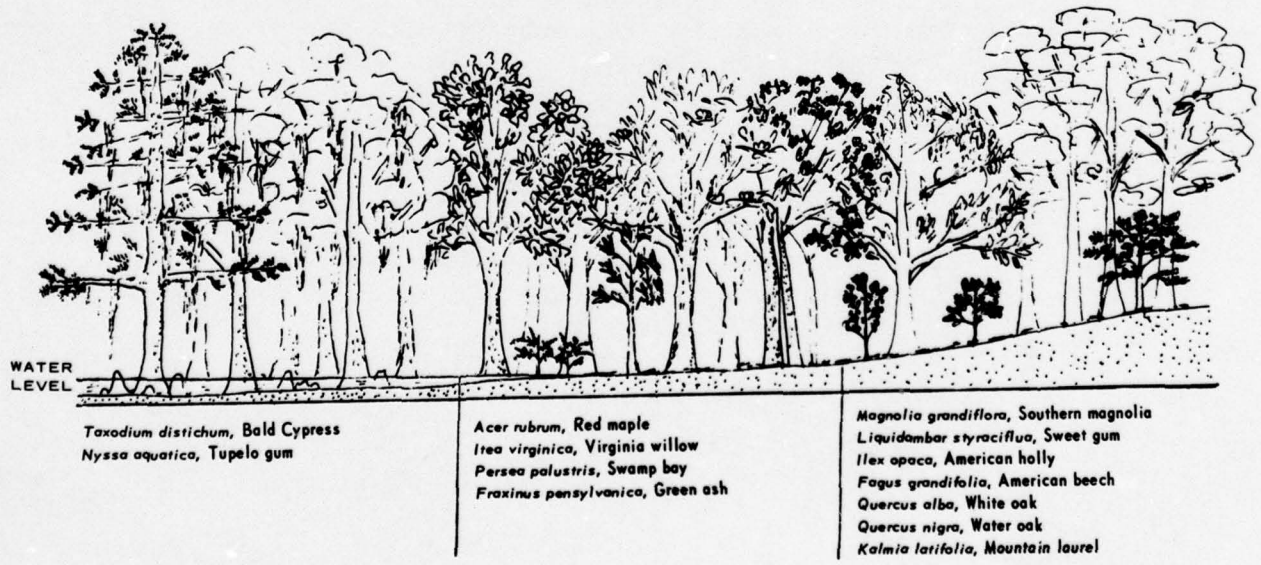

Figure 9. Transition from swamp through bottomland hardwoods complex into upland in the southern portion of the study area

Swamps with prolonged flooding. Cypress (*Taxodium distichum* and *T. ascendens*) and tupelo (*Nyssa aquatica* and *N. sylvatica* var. *biflora*) either together or separately dominate most of the freshwater swamps that are flooded for prolonged periods. Frequently one or more of these species are the only ones present in stands where the water depth exceeds 1 m. Bald cypress (*Taxodium distichum*) and Water tupelo (*Nyssa aquatica*) are characteristic of alluvial swamps, while nonalluvial swamps tend to be dominated by Pond pine (*Pinus serotina*), Swamp black gum (*Nyssa sylvatica* var. *biflora*), and Pond cypress (*Taxodium ascendens*). Buttonbush (*Cephalanthus occidentalis*) sometimes occurs in these deeper areas but is more abundant in slightly more shallow areas. While cypress and tupelo gums often occur to the total exclusion of other tree species on sites having deep prolonged flooding, the more shallow areas support a greater species diversity.

Sites having prolonged but shallow flooding typically support any or all of the following species: Red maple (usually *Acer rubrum* var. *drummondii*, Drummond's red maple), Water hickory or Bitter pecan (*Carya aquatica*), two species of hawthorn (*Crataegus opaca* and *C. viridis*), Swamp privet (*Forestiera acuminata*), Green ash (*Fraxinus pennsylvanica*), Pumpkin ash (*Fraxinus profunda*), Water locust (*Gleditsia aquatica*), Virginia willow (*Itea virginica*), Water elm (*Planera aquatica*), Swamp cottonwood (*Populus heterophylla*), Overcup oak (*Quercus lyrata*), and Black willow (*Salix nigra*). *Taxodium* spp. and *Nyssa* spp. also can be found in shallow waters. Herbaceous plants are sparse on sites having prolonged flooding of any depth; often they are found on stumps and detrital material. Species of widespread occurrence include False nettle (*Boehmeria cylindrica*), St. John's wort (*Hypericum walteri*), Lizard's tail (*Saururus cernuus*), and stick-tights (*Bidens* spp.). Species found in the freshwater aquatic wetland often occur also in the freshwater swamp, particularly where breaks in the canopy allow considerable light to reach the water.

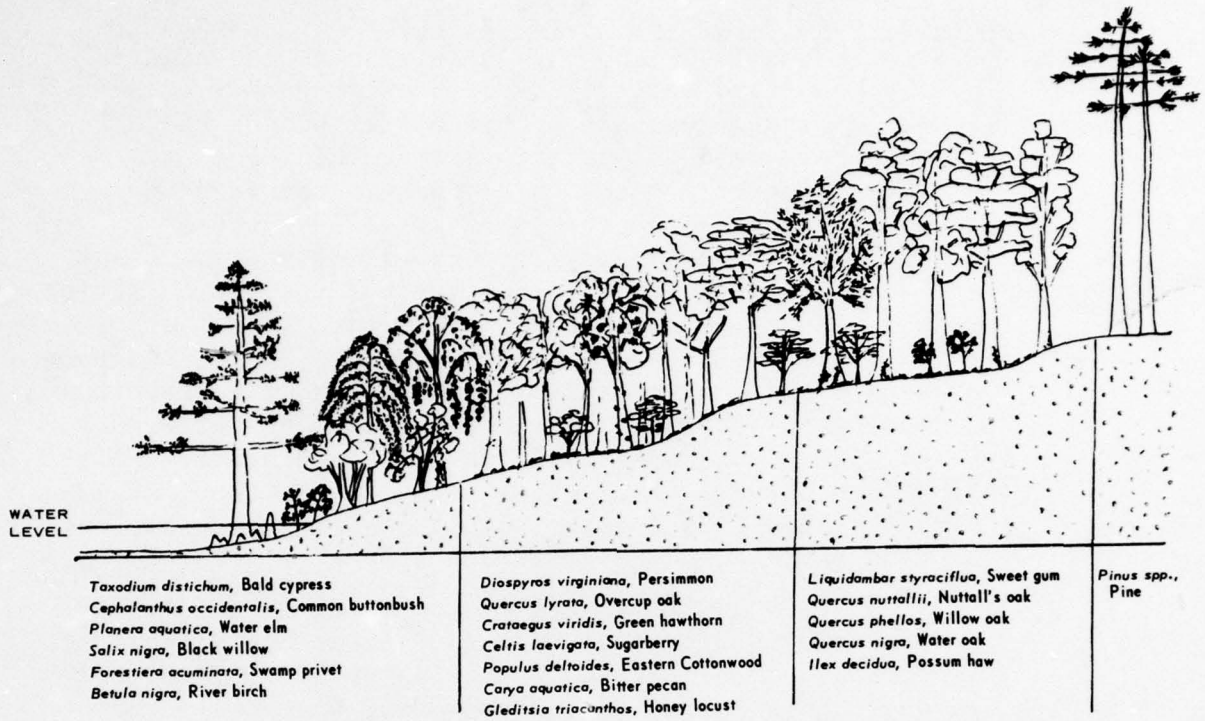

Figure 10. Transition from riparian swamp through first- and second-bottoms and into upland

Floodplain forests having seasonal flooding. Wetlands of this type, commonly referred to as bottomland hardwoods, have been and continue to be among the most controversial of all wetland habitats. The bottomland hardwoods are of wide distribution in the Gulf Coastal Plain, where they are of greater extent than in any other section of the country and are of much importance as sites for urbanization, agricultural production, and logging. These wetlands generally are among the highest and driest of all wetland types; consequently, many sectors among both private and governmental interests have preferred to exclude the bottomland hardwoods from consideration as wetlands.

Bottomland hardwoods technically satisfy the conditions of the Section 404 wetlands definition because these floodplain forests are characterized by cyclic inundation or soil saturation during portions of the growing season and by the presence of plant communities and associations that have been selected and maintained because of their ability to tolerate regular inundation or saturation. Studies such as those by Hall and Smith (1955) indicate that floodplain trees of the region are quite tolerant to extended periods of flood inundation. Putnam et al. (1960) showed that early spring flooding

will not kill most bottomland tree species if they are still dormant when flooded. Huffman (1976b) found that floods of short duration during the growing season play a major role in the selection of plant communities at particular points along the moisture gradient. The response of individual species to the flooding pattern determines community structure and composition.

From a practical standpoint, however, it may be essential to consider some part of the bottomland hardwoods as a transition zone between wetland and upland. Determination of exactly how much of the forested floodplain is wetland and under the jurisdiction of Section 404 is problematic until transition zones are better delineated following completion of field investigations currently being pursued by the Corps of Engineers.

Throughout most of the Gulf Coastal Plain, the structure and composition of the bottomland hardwoods forest is marked by subtle reassortment of species assemblages or communities along the extended moisture gradient. The bottomland hardwood forest is a complex of numerous species (nearly 40 commerical timber species), and any particular drainage basin will support a variety of communities.

The relationships of the various components of bottomland hardwoods to the freshwater swamps having prolonged flooding have not been well defined. Bottomland hardwood habitats are subject to frequent overflow as well as impoundment of surface waters and usually are flooded through late winter and spring, the water often standing for several months at a time. Additional flooding may occur in any part of the growing season, but in much of the lower Mississippi River valley, it is especially prevalent and severe during the months of April, May, and June. Following subsidence of the floodwaters, some sites maintain saturated or nearly saturated soils for long periods, although the soils of other sites dry out, often to the point of pronounced cracks in the soil. At that point, many would question whether such a site should be considered a wetland.

Some elements have suggested that Section 404 should apply only to bottomland hardwoods located in the first-bottoms; these persons would consider second-bottoms as upland, nonwetland habitats. The plant communities found on first- and second-bottoms of major streams typically are different in composition; some streams, however, do not exhibit the terraces necessary for the presence of second-bottoms. On the floodplains of

streams lacking second-bottoms, many of the second-bottom species (Box elder, Sugarberry, American holly, Sweet gum, etc.) are present within the floodplain. Determination of exactly how much of the floodplain is subject to Section 404 obviously is subject to differences of interpretation, and this discussion can offer only general guidance.

At the present time relatively little is known about the ecology of floodplain vegetation in the Gulf Coastal Plain as it relates to flood duration, magnitude, and intensity. Several studies have shown, however, that flooding is one of the major environmental influences on plant community structure in the floodplain forests. Species of the bottomland hardwoods exhibit distinct differences in relative tolerance to complete inundation when in the seedling stage of development (Hosner, 1958 and 1960): Box elder (*Acer negundo*), Buttonbush (*Cephalanthus occidentalis*), Eastern cottonwood (*Populus deltoides*), and Silver maple (*Acer saccharinum*) are considered tolerant to inundation, while American elm (*Ulmus americana*), Pin oak (*Quercus palustris*), Red maple (*Acer rubrum*), and Sycamore (*Platanus occidentalis*) are classed as intermediate; Cherrybark oak (*Quercus falcata* var. *pagodaefolia*), Hackberry (*Celtis laevigata*), Shumard oak (*Quercus shumardii*), and Sweetgum (*Liquidambar styraciflua*) are classed as intolerant of flooding (Hosner, 1958 and 1960). Huffman (1976b), in a study of first-bottom sites in Arkansas, has shown that seedlings of *Carpinus caroliniana* can develop on sites that are repeatedly flooded for relatively short time periods, while *Quercus nigra* seedlings did not show evidence of successful tolerance to the same inundation pattern. In the same study, it was shown that Cherrybark oak seedlings developed only on floodplain sites where one or more floods of equal to or greater than 5 days but less than 20 days duration each occurred during the first 30 days of the growing season followed by one or more floods of similar duration within the second 30 days of the growing season. These findings support the idea that species assemblages in the bottomland hardwoods complex are dependent upon regular inundations, with the magnitude, duration, and frequency of flooding playing a major role in community establishment and maintenance. Further studies along these lines are desirable to document the relationships of bottomland hardwoods to other wetland types.

Shrub bogs. Throughout the lower coastal plain are pockets of poor drainage (and often marked by seepage)

that are occupied by evergreen shrub bogs. These wetlands are dominated by shrub and small tree species and integrate freely with wet meadows (freshwater marsh); many herbaceous species are shared between the two wetlands. Such sites typically are acid in soil reaction and usually support a ground mat of peat moss (*Sphagnum* spp.) in various amounts. A wide diversity of species occurs in these shrub bogs. Dominant among the woody plants are numerous species, many of which are evergreen. Characteristic plants include several species of dogwoods (*Cornus* spp.), Leatherwood or Titi (*Cyrilla racemiflora*), St. John's worts (*Hypericum* spp.), huckleberries (*Gaylussacia* spp.), hollies (*Ilex* spp.), waxmyrtles (*Myrica* spp.), azaleas (*Rhododendron* spp.), blueberries (*Vaccinium* spp.), *Viburnum* spp., and Poison sumac (*Rhus vernix*). Herbaceous species are numerous and include many colorful and interesting species, such as several kinds of orchids (*Pogonia ophioglossoides*, *Calopogon pulchellus*, and *Habenaria* spp.), pitcher plants (*Sarracenia* spp.), and Grass-of-Parnassus (*Parnassia asarifolia*), as well as many of the species associated with the wet meadows.

Depressions in the uplands of the coastal plain often support pure stands of Southern white cedar (*Chamaecyparis thyoides*). These stands typically are found on peat deposits, and fire has been indicated as essential to their establishment. White cedar swamps once were a common feature of the Gulf Coastal Plain, but relatively few tracts of any size remain; one of the better stands may be seen in the vicinity of Van Cleave, Mississippi.

Transitional species. Cypress/tupelo communities often border or encircle deeper waters that support freshwater aquatic communities. Towards drier sites, they are more often adjacent to bottomland hardwoods, although hardwoods forest may border directly on aquatic communities or freshwater marshes. Determination of transition zones between swamps that are flooded for long periods of time and upland forest often is extremely difficult, because of the problem of determining how much if any of the bottomland hardwoods to include as transiton zone. The interface between swamps and pinelands often is occupied by either wet meadows or shrub bogs.

ENVIRONMENTAL CONDITIONS

99. Cypress communities can withstand nearly permanent inundation, but exposed saturated soils are necessary for seed germination. The pH of the soil and soil water appears to be the major factor separating the distribution of the two species of cypress. Pond cypress typically

occurs in acidic soils on upland sites where the pH ranges from 3.6 to 5.4. Bald cypress communities usually occur on alluvial soils having pH ranges from neutral to alkaline, although slightly acidic conditions may develop during the dry season. Bald cypress grows vigorously on deep muck or brown peat, clay, or fine sand. Pond cypress typically grows on fine sandy soil underlaid by hardpan.

100. Reproduction in freshwater swamps is dependent upon water level fluctuation. Seeds of the dominant species will not germinate under water, apparently a response to the low oxygen levels of swamp waters.

101. The processes of alluviation in valleys of the region, combined with down-cutting into older stream deposits, have resulted in the formation of natural levees, secondbottoms, and low alluvial ridges between streams. Development of the natural levees has resulted in a decrease of drainage capabilities in interstream bottomland areas and has contributed to the formation of extensive swamps and bayous.

FIELD IDENTIFICATION

102. Freshwater swamps are distinguished from adjacent wetlands by the presence of trees. Aquatic communities frequently border them in areas either too deep for cypress-tupelo or permanently flooded, which prevents germination of seeds. The transition of freshwater swamps to uplands, particularly to pinelands, is frequently gradual and delineation of the boundary is difficult. Some of the potential dominants and associated species of freshwater swamps in the region can be found also in sites that are not considered wetlands; in these cases, it may be necessary to select obligate upland species to more effectively establish the wetland boundary. Saw palmetto (*Serenoa repens*), for example, usually is an obligate upland species in the Gulf Coastal Plain and frequently can be used to distinguish wetland from upland communities.

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APPENDIX A: SCIENTIFIC AND COMMON NAMES OF PLANTS OF THE GULF COASTAL PLAIN

Scientific/Common Names

Acer negundo L.
Boxelder
Acer rubrum L.
Red maple
Acer saccharinum L.
Silver maple
Acnida cuspidata Spreng.
Southern waterhemp
Agalinis maritima (Raf.) Raf.
Seaside gerardia
Agrostis stolonifera L. (including plants often called A. alba)
Redtop
Aletris aurea Walt.
Yellow star-grass
Alisma subcordatum Raf.
Water plantain
Alnus serrulata (Ait.) Willd.
Smooth alder, Common alder
Alternanthera philoxeroides (Mart.) Griseb.
Alligator weed
Ammannia spp.
Tooth-cup
Amorpha fruticosa L.
Indigo bush
Aster dumosus L.
Aster
Aster lateriflorus (L.) Britt.
Aster
Aster spinosus Benth.
Aster
Aster subulatus Michx.
Annual saltmarsh aster
Aster tenuifolius L.
Perennial saltmarsh aster
Aster vimineus Lam.
Aster
Azolla caroliniana Willd.
Mosquito fern
Avicennia germinans (L.) L.
Black mangrove
Baccharis halimifolia L.
Sea myrtle, Groundsel

Bacopa caroliniana (Walt.) Robins.
Carolina hyssop
Bacopa monnieri (L.) Wettst.
Water hyssop
Bacopa rotundifolia (Michx.) Wettst.
Roundleaf bacopa
Batis maritima L.
Saltwort
Betula nigra L.
River birch
Bidens laevis (L.) BSP.
Stick-tight, Beggar-tick
Bidens discoidea (T. & G.) Britt.
Tickweed, Stick-tight
Bidens polylepis Blake
Stick-tight, Beggar-tick
Boehmeria cylindrica (L.) Sw.
False nettle
Borrichia frutescens (L.) DC.
Sea ox-eye
Brasenia schreberi J. F. Gmel.
Water shield
Cabomba caroliniana Gray
Cabomba, Fanwort
Callitriche heterophylla Pursh
Water starwort
Calopogon pulchellus (Salisb.) R. Br.
Grass pink
Carex crinita Lam.
Caric-sedge
Carex hyalinolepis Steud.
Caric-sedge
Carex lupulina Muhl.
Caric-sedge
Carex vulpinoidea Michx.
Caric-sedge
Carpinus caroliniana Walt.
Blue beech, Ironwood
Carya aquatica (Michx. f.) Nutt.
Water hickory, Bitter pecan
Celtis laevigata Willd.
Sugarberry
Cenchrus spp.
Sandbur
Cephalanthus occidentalis L.
Buttonbush
Ceratophyllum demersum L.
Common hornwort
Chamaecyparis thyoides (L.) BSP.
Southern white cedar

Cladium jamaicense Crantz
Sawgrass
Clethra alnifolia L.
Pepperbush
Colocasia antiquorum Schott.
Elephant's ear
Cornus spp.
Dogwood
Crataegus opaca H. & A.
Mayhaw
Crataegus viridis L.
Green hawthorn
Cymodocea filiformis (Kutz) Correll
Manatee grass
Cyperus articulatus L.
Cyperus, Flat-sedge
Cyperus compressus L.
Cyperus, Flat-sedge
Cyperus erythrorhizos Muhl.
Red-root cyperus, Flat-sedge
Cyperus ferruginescens Boeckler
Cyperus, Flat-sedge
Cyperus odoratus L.
Cyperus, Flat-sedge
Cyperus strigosus L.
Cyperus, Flat-sedge
Cyrilla racemiflora L.
Leatherwood, Titi
Daubentonia sp.
Rattlebox
Decumaria barbara L.
Climbing hydrangea
Distichlis spicata (L.) Greene
Saltgrass
Echinochloa crus-galli (L.) Beauv.
Barnyard grass
Echinochloa walteri (Pursh) Heller
Walter's millet
Eichhornia crassipes (Mart.) Solms.
Water hyacinth
Eleocharis cellulosa Torr.
Gulf spikerush
Eleocharis equisetoides (Ell.) Torr.
Northern jointed spikerush
Eleocharis parvula (R. & S.) Link.
Dwarf spikerush
Eragrostis hypnoides (Lam.) BSP.
Creeping lovegrass
Erianthus giganteus (Walt.) Muhl.
Sugarcane plumegrass

Eriocaulon spp.
Pipewort
Eupatorium perfoliatum L.
Thoroughwort
Eupatorium purpureum L.
Joe-pye weed
Eupatorium serotinum Michx.
Late boneset
Fimbristylis castanea (Michx.) Vahl
Sand rush, Saltmarsh fimbristylis
Forestiera acuminata (Michx.) Poir.
Swamp privet
Fraxinus caroliniana Mill.
Carolina ash, Water ash
Fraxinus pennsylvanica Marsh.
Green ash
Fraxinus profunda (Bush) Bush
Pumpkin ash
Gaylussacia spp.
Huckleberry
Gleditsia aquatica Marsh.
Water locust
Glyceria spp.
Manna grass
Gratiola virginiana L.
Hedge hyssop
Habenaria spp.
Bog-orchid
Halodule beaudettei (den Hartog) den Hartog
Shoal weed
Halophila baillonis Asch.
Caribbean halophila
Halophila engelmannii Asch.
Gulf halophila
Heliotropium curassavicum L.
Seaside heliotrope
Hibiscus lasiocarpus Cav.
Rose mallow
Hydrocotyle ranunculoides L. f.
Pennywort
Hydrocotyle umbellata L.
Pennywort
Hymenocallis caroliniana (L.) Herb.
Spiderlily
Hypericum walteri Gmel.
St. John's wort
Ilex decidua Walt.
Possum-haw
Ilex glabra (L.) Gray
Inkberry,

Ilex opaca Ait.
American holly
Ilex vomitoria Ait.
Yaupon
Ilex spp.
Holly
Ipomoea pes-caprae (L.) Sweet
Beach morning glory
Itea virginica L.
Virginia willow
Iva frutescens L.
Marsh elder
Juncus effusus L.
Soft sedge, Soft rush
Juncus roemerianus Scheele
Black rush
Juncus spp.
Rush
Kosteletskya virginica (L.) Gray
Pink hibiscus
Lachnocaulon anceps (Walt.) Morong.
Bog-button
Leersia oryzoides (L.) Swartz.
Rice cutgrass
Leersia spp.
Cutgrass
Lemna spp.
Duckweed
Leptochloa spp.
Sprangletop
Limnobium spongia (Bosc.) Steud.
Frog's bit
Liquidambar styraciflua L.
Sweet gum
Ludwigia palustris (L.) Ell.
Marsh purslane
Ludwigia peploides (HBK.) Raven
Water primrose
Ludwigia spp.
Seedbox
Lycopodium spp.
Clubmoss
Lyonia lucida (Lam.) K. Koch
Fetterbush
Lythrum lineare L.
Saltmarsh loosestrife
Magnolia virginiana L.
Bay magnolia, White bay
Mikania scandens (L.) Willd.
Climbing hemp

Myrica heterophylla Raf.
Wax myrtle
Myrica spp.
Wax myrtle
Myriophyllum brasiliense Camb.
Parrot's feather
Myriophyllum pinnatum (Walt.) BSP.
Watermilfoil, Green parrot's feather
Myriophyllum spicatum L.
Eurasian watermilfoil
Myriophyllum spp.
Watermilfoil
Najas guadalupensis (Spreng.) Magnus
Southern naiad
Nelumbo lutea (Willd.) Pers.
American lotus
Nuphar luteum (L.) Sibth. & Sm.
Spatterdock
Nymphaea odorata Ait.
White waterlily
Nymphoides aquatica (Gmel.) O. Ktze.
Floating heart
Nyssa aquatica L.
Water tupelo
Nyssa sylvatica Marsh.
Black gum
Nyssa sylvatica var. biflora (Walt.) Sarg.
Swamp black gum
Osmunda cinnamomea L.
Cinnamon fern
Osmunda regalis L.
Royal fern
Ottelia alismoides (L.) Pers.
Duck-lettuce
Panicum hemitomon Schult.
Maidencane
Panicum virgatum L.
Switch grass
Paspalum setaceum Michx.
Paspalum grass
Paspalum vaginatum Sw.
Joint grass
Parnassia asarifolia Vent.
Grass-of-Parnassus
Persea palustris (Raf.) Sarg.
Swamp bay
Philoxerus vermicularis (L.) R. Br.
Beach carpet
Phragmites communis Trin.
Reed, Roseau

Pinguicula spp.
Butterwort
Pinus serotina Michx.
Pond pine
Pinus taeda L.
Loblolly pine
Pistia stratiotes L.
Water lettuce
Planera aquatica (Walt.) J. F. Gmel.
Water elm
Platanus occidentalis L.
Sycamore
Pluchea purpurascens (Sw.) DC.
Camphor weed
Pogonia ophioglossoides (L.) Ker.
Rose pogonia
Polygala spp.
Milkwort
Polygonum spp.
Smartweed
Polypodium polypodioides (L.) Walt.
Resurrection fern
Pontederia cordata L.
Pickerel weed
Populus deltoides Marsh.
Eastern cottonwood
Populus heterophylla L.
Swamp cottonwood
Potamogeton capillaceus Poir.
Pondweed, Snailseed pondweed
Potamogeton diversifolius Raf.
Pondweed, Waterthread pondweed
Potamogeton spp.
Pondweed
Quercus falcata var. pagodaefolia Ell.
Cherrybark oak
Quercus laurifolia Michx.
Laurel oak
Quercus lyrata Walt.
Overcup oak
Quercus nigra L.
Water oak
Quercus nuttallii Palmer
Nuttall's oak
Quercus palustris Muench.
Pin oak
Quercus phellos L.
Willow oak
Quercus shumardii Buckl.
Shumard oak

Quercus stellata var. mississippiensis (Ashe) Little
Delta post oak
Quercus virginiana Mill.
Live oak
Ranunculus pusillus Poir.
Crowfoot
Ranunculus sardous Crantz.
Buttercup
Ranunculus sceleratus L.
Cursed crowfoot
Rhexia spp.
Meadow beauty
Rhododendron spp.
Azalea
Rhus vernix L.
Poison sumac
Rhynchospora spp.
Beaked sedge
Rumex verticillatus L.
Swamp dock
Ruppia maritima L.
Widgeon grass
Sacciolepis striata (L.) Nash
Bagscale
Sagittaria lancifolia L.
Bulltongue
Sagittaria latifolia
Common arrowhead
Sagittaria platyphylla Engelm.
Delta arrowhead
Sagittaria subulata (L.) Bunch.
Dwarf arrowhead
Salicornia bigelovii Torr.
Glasswort
Salicornia virginica L. (incl. plants referred to as S. perennis)
Glasswort
Salix nigra Marsh.
Black willow
Sarracenia spp.
Pitcher plant
Saururus cernuus L.
Lizard's tail
Scirpus atrovirens Willd.
Bulrush
Scirpus californicus (C. A. Mey.) Steud.
Giant bulrush, Tule
Scirpus cyperinus (L.) Kunth.
Woolgrass
Scirpus lineatus Michx.
Bulrush

Scirpus maritimus L. (incl. S. robustus Pursh)
Leafy three-square, Saltmarsh bulrush
Scirpus olneyi Gray
Three-cornered grass
Scirpus validus Vahl.
Softstem bulrush
Sesbania macrocarpa Muhl.
Sesbania, Rattlebox
Sesuvium spp.
Sea purslane
Setaria magna Griseb.
Giant foxtail
Solidago sempervirens L.
Goldenrod
Solidago spp.
Goldenrod
Sparganium americanum Nutt.
Bur-reed
Spartina alterniflora Lois.
Smooth cordgrass, Oystergrass
Spartina cynosuroides (L.) Roth.
Big cordgrass, Hogcane
Spartina patens (Aig.) Muhl.
Saltmeadow cordgrass, Wiregrass
Spartina spartinae (Trin.) Hitchc.
Gulf cordgrass, Prickly cordgrass
Spiranthes spp.
Ladies'-tresses
Spirodela polyrhiza (L.) Schleid.
Duck-meat
Spirodela spp.
Duck-meat
Stachys tenuifolia Willd.
Hedge-nettle
Styrax americana Lam.
Storax
Suaeda linearis (Ell.) Moq.
Sea blite
Taxodium ascendens Brongn.
Pond cypress
Taxodium distichum (L.) Rich.
Bald cypress
Teucrium canadense L.
Germander
Thalassia testudinum Konig
Turtle grass
Thelypteris palustris Schott.
Marsh fern
Typha angustifolia L.
Narrow-leaved cattail

Typha domingensis Pers.
Cattail
Typha latifolia L.
Common cattail
Ulmus alata Michx.
Winged elm
Ulmus americana L.
American elm
Uniola paniculata L.
Sea oats
Utricularia spp.
Bladderwort
Vallisneria americana Michx.
Wild celery
Viburnum spp.
Viburnum
Vigna luteola (Jacq.) Benth.
Deer pea
Vitis palmata Vahl
Red grape
Wolffia spp.
Watermeal
Wolffiella floridana (J. D. Sm.) Thomps.
Bog-mat
Wolffiella spp.
Bog-mat
Woodwardia virginica (L.) Sm.
Virginia chain fern
Xyris spp.
Yellow-eyed grass
Zizaniopsis miliacea (Michx.) Doell. & Asch.
Southern wild rice

Alligator weed
Alternanthera philoxeroides (Mart.) Griseb.
American elm
Ulmus americana L.
American holly
Ilex opaca Ait.
American lotus
Nelumbo lutea (Willd.) Pers.
Annual saltmarsh aster
Aster subulatus Michx.
Aster
Aster dumosus L.
Aster
Aster lateriflorus (L.) Britt.
Aster
Aster spinosus Benth.
Aster
Aster vimineus Lam.
Azalea
Rhododendron spp.
Bagscale
Sacciolepis striata (L.) Nash
Bald cypress
Taxodium distichum (L.) Rich.
Barnyard grass
Echinochloa crus-galli (L.) Beauv.
Bay magnolia
Magnolia virginiana L.
Beach carpet
Philoxerus vermicularis (L.) R. Br.
Beach morning glory
Ipomoea pes-caprae (L.) Sweet
Beaked sedge
Rhynchospora spp.
Beggar-tick
Bidens laevis (L.) BSP.
Beggar-tick
Bidens polylepis Blake
Big cordgrass
Spartina cynosuroides (L.) Roth.
Bitter pecan
Carya aquatica (Michx. f.) Nutt.
Black gum
Nyssa sylvatica Marsh.
Black mangrove
Avicennia germinans (L.) L.
Black rush
Juncus roemerianus Scheele

Black willow
Salix nigra Marsh.
Bladderwort
Utricularia spp.
Blue beech
Carpinus caroliniana Walt.
Bog-button
Lachnocaulon anceps (Walt.) Morong
Bog-mat
Wolffiella floridana (J. D. Sm.) Thomps.
Bog-mat
Wolffiella spp.
Bog-orchid
Habenaria spp.
Boxelder
Acer negundo
Bulltongue
Sagittaria lancifolia L.
Bulrush
Scirpus atrovirens Willd
Bulrush
Scirpus lineatus Michx.
Bur-reed
Sparganium americanum Nutt.
Buttercup
Ranunculus sardous Crantz.
Butterwort
Pinguicula spp.
Buttonbush
Cephalanthus occidentalis L.
Cabomba
Cabomba caroliniana Gray
Camphor weed
Pluchea camphorata (L.) DC.
Caribbean halophila
Halophila baillonis Asch.
Caric-sedge
Carex crinita Lam.
Caric-sedge
Carex hyalinolepis Steud.
Caric-sedge
Carex lupulina Muhl.
Caric-sedge
Carex vulpinoidea Michx.
Carolina ash
Fraxinus caroliniana Mill.
Carolina hyssop
Bacopa caroliniana (Walt.) Robins.
Cattail
Typha domingensis Pers.

Cherrybark oak
Quercus falcata var. pagodaefolia Ell.
Cinnamon fern
Osmunda cinnamomea L.
Climbing hemp
Mikania scandens (L.) Willd.
Climbing hydrangea
Decumaria barbara L.
Clubmoss
Lycopodium spp.
Common alder
Alnus serrulata (Ait.) Willd.
Common arrowhead
Sagittaria latifolia Willd.
Common buttonbush
Cephalanthus occidentalis L.
Common cattail
Typha latifolia L.
Common duckweed
Lemna minor L.
Common hornwort
Ceratophyllum demersum L.
Creeping lovegrass
Eragrostis hypnoides (Lam.) BSP.
Crowfoot
Ranunculus pusillus Poir.
Cursed crowfoot
Ranunculus sceleratus L.
Cutgrass
Leersia spp.
Cyperus
Cyperus articulatus L.
Cyperus
Cyperus compressus L.
Cyperus
Cyperus ferruginescens Boeckler
Cyperus
Cyperus odoratus L.
Cyperus
Cyperus strigosus L.
Deer pea
Vigna luteola (Jacq.) Benth.
Delta arrowhead
Sagittaria platyphylla Engelm.
Delta post oak
Quercus stellata var. mississippiensis (Ashe) Little
Dogwood
Cornus spp.
Duck-lettuce
Ottelia alismoides (L.) Pers.

Duck-meat
Spirodela polyrhiza (L.) Schleid.
Duck-meat
Spirodela spp.
Duckweed
Lemna spp.
Dwarf arrowhead
Sagittaria subulata (L.) Bunch.
Dwarf spikerush
Eleocharis parvula (R. & S.) Link.
Eastern cottonwood
Populus deltoides Marsh.
Elephant's ear
Colocasia antiquorum Schott
Eurasian watermilfoil
Myriophyllum spicatum L.
False nettle
Boehmeria cylindrica (L.) Sw.
Fanwort
Cabomba caroliniana Gray
Fetterbush
Lyonia lucida (Lam.) K. Koch
Flat-sedge
Cyperus articulatus L.
Flat-sedge
Cyperus compressus L.
Flat-sedge
Cyperus erythrorhizos Muhl.
Flat-sedge
Cyperus ferruginescens Boeckler
Flat-sedge
Cyperus odoratus L.
Flat-sedge
Cyperus strigosus L.
Floating heart
Nymphoides aquatica (Gmel.) O. Ktze.
Frog's bit
Limnobium spongia (Bosc.) Steud.
Giant bulrush
Scirpus californicus (C. A. Mey.) Steud.
Giant foxtail
Setaria magna Griseb.
Germander
Teucrium canadense L.
Glasswort
Salicornia bigelovii Torr.
Glasswort
Salicornia virginica L.
Goldenrod
Solidago sempervirens L.

Goldenrod
Solidago spp.
Grass-of-Parnassus
Parnassia asarifolia Vent.
Grass pink
Calopogon pulchellus (Salisb.) R. Br.
Green ash
Fraxinus pennsylvanica Marsh.
Green hawthorn
Crataegus viridis L.
Green parrot's feather
Myriophyllum pinnatum (Walt.) BSP.
Gulf cordgrass
Spartina spartinae (Trin.) Hitchc.
Gulf halophila
Halophila engelmannii Asch.
Gulf spikerush
Eleocharis cellulosa Torr.
Hedge hyssop
Gratiola virginiana L.
Hedge-nettle
Stachys tenuifolia Willd.
Hogcane
Spartina cynosuroides (L.) Roth
Holly
Ilex spp.
Huckleberry
Gaylussacia spp.
Indigo bush
Amorpha fruticosa L.
Ironwood
Carpinus caroliniana Walt.
Joe-pye weed
Eupatorium purpureum L.
Joint grass
Paspalum vaginatum Sw.
Ladies'-tresses
Spiranthes spp.
Laurel oak
Quercus laurifolia Michx.
Leafy three-square
Scirpus maritimus L.
Leatherwood
Cyrilla racemiflora L.
Live oak
Quercus virginiana Mill.
Lizard's tail
Saururus cernuus L.
Loblolly pine
Pinus taeda L.

Maidencane
Panicum hemitomon Schult.
Manatee grass
Cymodocea filiformis (Kutz.) Correll
Manna grass
Glyceria spp.
Marsh elder
Iva frutescens L.
Marsh fern
Thelypteris palustris Schott.
Marsh purslane
Ludwigia palustris (L.) Ell.
Mayhaw
Crataegus opaca H. & A.
Meadow beauty
Rhexia spp.
Milkwort
Polygala spp.
Mosquito fern
Azolla caroliniana Willd.
Mountain laurel
Kalmia latifolia L.
Narrow-leaved cattail
Typha angustifolia L.
Northern jointed spikerush
Eleocharis equisetoides (Ell.) Torr.
Nuttall's oak
Quercus nuttallii Palmer
Overcup oak
Quercus lyrata Walt.
Oystergrass
Spartina alterniflora Lois.
Parrot's feather
Myriophyllum brasiliense Camb.
Paspalum grass
Paspalum setaceum Michx.
Pennywort
Hydrocotyle ranunculoides L. f.
Pennywort
Hydrocotyle umbellata L.
Pepperbush
Clethra alnifolia L.
Pickerel weed
Pontederia cordata L.
Pin oak
Quercus palustris Muench.
Pink hibiscus
Kosteletskya virginica (L.) Gray
Pipewort
Eriocaulon spp.

Pitcher plant
Sarracenia spp.
Poison sumac
Rhus vernix L.
Pond cypress
Taxodium ascendens Brongn.
Pond pine
Pinus serotina Michx.
Pondweed
Potamogeton capillaceus Poir.
Pondweed
Potamogeton diversifolius Raf.
Pondweed
Potamogeton spp.
Possum-haw
Ilex decidua Walt.
Prickly cordgrass
Spartina spartinae (Trin.) Hitchc.
Pumpkin ash
Fraxinus profunda (Bush) Bush
Rattlebox
Daubentonia spp.
Red maple
Acer rubrum L.
Red-grape
Vitis palmata
Redtop
Agrostis stolonifera L.
Reed
Phragmites communis Trin.
Resurrection fern
Polypodium polypodioides (L.) Walt.
Rice cutgrass
Leersia oryzoides (L.) Swartz.
River birch
Betula nigra L.
Rose mallow
Hibiscus lasiocarpus Cav.
Rose pogonia
Pogonia ophioglossoides (L.) Ker.
Roseau
Phragmites communis Trin.
Roundleaf bacopa
Bacopa rotundifolia (Michx.) Wettst.
Royal fern
Osmunda regalis L.
Rush
Juncus spp.
Saltgrass
Distichlis spicata (L.) Greene

Saltmarsh bulrush
Scirpus maritimus L.
Saltmarsh fimbristylis
Fimbristylis castanea (Michx.) Vahl
Saltmarsh loosestrife
Lythrum lineare L.
Saltmeadow cordgrass
Spartina patens (Ait.) Muhl.
Saltwort
Batis maritima L.
Sand rush
Fimbristylis castanea (Michx.) Vahl
Sandbur
Cenchrus spp.
Sawgrass
Cladium jamaicense Crantz
Sea blite
Suaeda linearis (Ell.) Moq.
Sea myrtle
Baccharis halimifolia L.
Sea oats
Uniola paniculata L.
Sea ox-eye
Borrichia frutescens (L.) DC.
Sea purslane
Sesuvium spp.
Seaside gerardia
Gerardia maritima L.
Seaside heliotrope
Heliotropium curassavicum L.
Seedbox
Ludwigia spp.
Sesbania
Sesbania macrocarpa Muhl.
Shoal weed
Halodule beaudettei (den Hartog) den Hartog
Shumard oak
Quercus shumardii Buckl.
Silver maple
Acer saccharinum L.
Smartweed
Polygonum spp.
Smooth alder
Alnus serrulata (Ait.) Willd.
Smooth cordgrass
Spartina alterniflora Lois.
Snailseed pondweed
Potamogeton capillaceus Poir.
Soft rush
Juncus effusus L.

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MAJOR ASSOCIATION..(U) ARMY ENGINEER WATERWAYS
EXPERIMENT STATION VICKSBURG MISS MAY 78 WES-TR-Y-78-5

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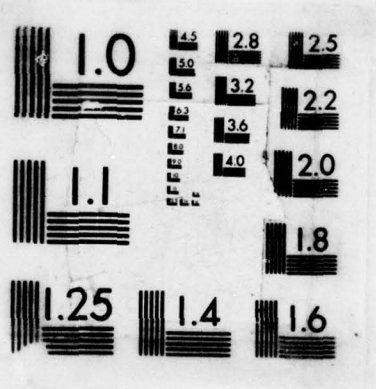
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Soft sedge
Juncus effusus L.
Softstem bulrush
Scirpus validus Vahl
Southern naiad
Najas guadalupensis (Spreng.) Magnus
Southern waterhemp
Acnida cuspidata Spreng.
Southern white cedar
Chamaecyparis thyoides (L.) BSP.
Southern wild rice
Zizaniopsis miliacea (Michx.) Doell. & Asch.
Spatterdock
Nuphar luteum (L.) Sibth. & Sm.
Spiderlily
Hymenocallis spp.
Sprangletop
Leptochloa spp.
St. John's wort
Hypericum walteri Gmel.
Stick-tight
Bidens laevis (L.) BSP.
Stick-tight
Bidens discoidea (T. & G.) Britt.
Stick-tight
Bidens polylepis Blake
Storax
Styrax americana Lam.
Sugarberry
Celtis laevigata Willd.
Sugarcane plumegrass
Erianthus giganteus (Walt.) Muhl.
Sundew
Drosera spp.
Swamp bay
Persea palustris (Raf.) Sarg.
Swamp black gum
Nyssa biflora (Walt.) Sarg.
Swamp cottonwood
Populus heterophylla L.
Swamp dock
Rumex verticillatus L.
Swamp privet
Forestiera acuminata (Michx.) Poir.
Sweet gum
Liquidambar styraciflua L.
Switch grass
Panicum virgatum L.
Sycamore
Platanus occidentalis L.

Thoroughwort
Eupatorium perfoliatum L.
Three-cornered grass
Scirpus olneyi Gray
Titi
Cyrilla racemiflora L.
Toothcup
Ammannia spp.
Tule
Scirpus californicus (C. A. Mey.) Steud.
Turtle grass
Thalassia testudinum Konig
Viburnum
Viburnum spp.
Virginia chain fern
Woodwardia virginica (L.) Sm.
Virginia willow
Itea virginica L.
Walter's millet
Echinochloa walteri (Pursh) Heller
Water ash
Fraxinus caroliniana Mill.
Water elm
Planera aquatica (Walt.) J. F. Gmel.
Water hickory
Carya aquatica (Michx. f.) Nutt.
Water hyacinth
Eichhornia crassipes (Mart.) Solms.
Water hyssop
Bacopa monnieri (L.) Wettst.
Water lettuce
Pistia stratiqtes L.
Water locust
Gleditsia aquatica Marsh.
Water oak
Quercus nigra L.
Watermeal
Wolffia spp.
Watermilfoil
Myriophyllum pinnatum (Walt.) BSP.
Watermilfoil
Myriophyllum spp.

APPENDIX B: GLOSSARY

ABUNDANCE: a term used in quantitative vegetation sampling, referring to density of a given species per unit area; usually expressed as the total number of individual organisms in a unit area.

ACIDIC: having a pH value of less than 7, nonalkaline.

ALGAE: a nonvascular chlorophyll-bearing organism, common to various types of wetlands and very important in productivity.

ALKALINE: having a pH value greater than 7, nonacidic.

ANGIOSPERM: a plant characterized by flowers and seeds enclosed in fruits; e.g., orchids, palms, oaks, etc.

ANNUAL: a plant in which the entire life cycle is completed in a single growing season.

AQUATIC VEGETATION: a plant characteristically growing wholly or partly submerged in water.

AUTHORITY: the name of the person or persons who first described a particular plant to science, appearing in conjunction with a scientific name; e.g., *Typha latifolia* L. (the L. representing the botanist Linnaeus).

BACKWATER: an accumulation of usually quiet water, held back by a natural dike, high tides, or unusually high water levels in creeks, rivers, or lakes.

BANANA HOLE: type of freshwater swamp occurring in small sinkholes in Florida.

BARRIER ISLAND: an offshore island, similar to a bar, except with ridges, vegetation, and swampy tracts.

BAY: a body of water, smaller than a gulf, located in a recess in the shoreline.

BAYHEAD: a regional name applied to a type of freshwater swamp in Florida, dominated by a mixture of hardwood species.

BAYOU: a small, sluggish secondary stream or lake, often existing as an area of backwater in an abandoned channel.

BIENNIAL: a plant normally requiring two growing seasons to complete its life cycle; vegetative growth appears the first year and flowering and fruiting follow in the second year.

BOG: a vegetation type usually denoting an area of wet, acid peat.

BRACKISH: referring to water or soils having salinity contents of 0.5 to 30 ppt (o/oo).

BROADLEAF: having broad, flat leaves; usually referring to angiosperms (flowering plants) as contrasted with the needle-leaves of many gymnosperms.

CARR: a poorly defined regional wetland term, used primarily in parts of the Midwest; refers to a successional community (dominated by shrubs) that appears between marsh and swamp formation.

CLIMAX: the terminal community of a particular plant succession sequence, maintaining itself relatively unchanged unless the environment changes.

COASTAL FLAT: wetland type having 25 percent or less vegetative cover and that is occasionally or regularly flooded by saline water of tidal origin.

COLONY: a group of organisms of the same species growing in a localized area, often used to refer to a group of plants becoming established in a new situation.

COMMUNITY: a distinctive combination of two or more ecologically related species, living together and interacting with each other in a characteristic natural habitat.

CONIFER: a common term for any gymnosperm of the order Coniferales (the group containing those gymnosperms producing definite cones, as pine, spruce, etc.).

COVER: a term used in quantitative vegetation sampling, referring to the amount (percent) of ground with vegetation above it; estimated by vertically projecting the outline of the crown onto the ground.

dbh: diameter (of a tree) at breast height.

DECIDUOUS: shedding of leaves at end of growing season (or sometimes, in the Southwest, under periods of environmental stress before the end of the growing season); usually referring to broad-leaved woody angiosperms (flowering plants) but sometimes referring to gymnosperms (e.g., Bald cypress).

DEFLATION PLAIN BASIN: a basin formed in arid areas by removal of loose material from an area by wind.

DETRITAL: referring to dead organic tissues, decomposed material, and organisms in an ecosystem; usually including the live microorganisms involved in the decomposition of the material.

DISCLIMAX: a potentially long-persisting and self-reproducing vegetation type, maintaining its composition and structure only as a consequence of continuing disturbance (as by fire, grazing, etc.).

DOMINANT: a prevailing species of an area; a species that to a considerable extent controls the conditions for existence of its associates within an ecosystem.

DWARF SHRUB: woody plants characterized by numerous stems and rarely exceeding 50 cm in height.

ECOTONE: the transition zone between two or more adjacent plant communities, usually containing species from each of the adjacent vegetation types.

EMERSED: standing out above the water, as the leaves of certain hydrophytes.

EMERGENT: same as EMERSED.

EPIPHYTE: a plant that grows on another plant for support but is not parasitic on it.

ESTUARY: a basin in which river water mixes with and dilutes sea water.

EVERGREEN: a perennially green plant, never losing all its leaves at one time.

FEN: a poorly defined regional term for a type of marsh; usually said to be formed on peat that is circumneutral or alkaline in pH; vegetation marked by high species diversity; equivalent to the sedge-meadow of many authors.

FLOATING-LEAVED COMMUNITY: an aquatic assemblage dominated by species having leaves that float on the water surface, often floating by virtue of long flexuous petioles (such as most water lilies).

FLORA: the vegetation of an area; also used to denote a book for identification of plant species in an area.

FORBS: associated herbaceous species other than grasses; term used in ecological description of nonwoody vegetation.

FREQUENCY: a term used in quantitative vegetation sampling, relating to the number of times a species occurs in a given number of sample plots; expressed as a fraction of the total, usually in percent.

FRESH WATER: water containing less than 0.5 ppt (o/oo) salinity.

FRESHWATER AQUATIC COMMUNITY: a wetland dominated by free-floating or rooted aquatic herbs and that is semipermanently or permanently flooded by fresh water (e.g., a patch of water lilies).

FRESHWATER INLAND FLAT: a wetland having less than 25 percent vegetative cover and that is occasionally or regularly flooded by fresh water (e.g., mudflats).

FRESHWATER MARSH: a wetland having more than 25 percent vegetative cover by terrestrial herbs but 40 percent or less cover by woody plants, occasionally or regularly flooded by fresh water (e.g., sawgrass prairie).

FRESHWATER SWAMP: a wetland having more than 40 percent cover by woody plants and that is occasionally or regularly flooded by fresh water (e.g., cypress swamp).

GENUS (plural GENERA): a taxonomic category that represents a group of closely related species (e.g., all kinds of cattail are placed in the single genus *Typha*).

GRAMINOID: a term referring to grasses or grasslike plants (including the grasses, sedges, rushes, etc.).

GRASS-SEDGE BOG: a wet peatland dominated by grasses and sedges.

GROUNDWATER: water contained in rocks below the water table.

GROWTH FORM: a descriptive concept of vegetation based on some particular characteristic, such as deciduous versus evergreen and broad-leaf versus needle-leaf.

GUT: a narrow inlet of water along a coastline.

GYMNOSPERM: any of a number of different kinds of woody seed-plants in which the seeds are not enclosed in a fruit (e.g., pine, cedar, etc.).

HALOPHYTE: any plant species capable of tolerating salinity levels of more than 0.5 ppt (o/oo).

HAMMOCK: a dense growth of broad-leaved trees on a slight elevation; not considered wet enough to be a swamp.

HARDPAN: a hard, impervious subsurface layer of clay soil, usually impervious to both water and root penetration.

HARDWOOD: a broad-leaved angiosperm (flowering plant) tree having wood characterized by the presence of specialized cells called vessels.

HERB: a nonwoody plant--annual, biennial, or perennial--whose above-ground parts are short lived (in temperate regions, only one growing season).

HERBACEOUS: the adjective used to describe plants that are herbs.

HYDRIC: aquatic.

HYDROPHYTE: a plant growing in water or in characteristically wet soil.

HYPERSALINE: soil or water with a high salt content.

IMPOUNDMENT: standing body of open water created by artifically blocking or restricting the flow of a river, stream, or tidal area.

INTERMITTENT STREAM: a stream receiving its water primarily from surface runoff.

INTERTIDAL ZONE: in coastal areas, the region between levels of high tide and low tide.

KARST TOPOGRAPHY: a topography formed over limestone, dolomite, or gypsum and characterized by sinkholes, caves, and underground drainage.

KELP: any of the various large, coarse brown seaweeds (brown algae) of marine waters.

LACUSTRINE: pertaining to a lake.

LAGOON: a shallow coastal body of water, partly separated from the sea by beaches or islands; usually a lagoon is elongate and parallel to the shoreline and characterized by higher salinity than found in an estuary.

LAKE: a natural depression fed by one or more streams and from which a stream may flow; occurs due to widening or natural blockage of a river or stream or occurs in an isolated natural depression that is not part of a surface river or stream; usually too deep to permit the growth of rooted plants from shore to shore.

LIANA: a woody or herbaceous climbing plant--a vine--with its roots in the soil.

LITTORAL: that portion of a body of water extending from shoreline toward the middle of the water to the limit of occupancy by rooted plants.

MANUAL: a handbook used in the taxonomic identification of plant species.

MARL: a deposit of crumbly, earthy material, usually composed of clay mixed with limestone or other carbonate.

MARSH: a wetland dominated by nonwoody vegetation; if woody plants are present, they account for less than 40 percent vegetative cover.

MESIC: pertaining to a habitat characterized by a medium amount of water, neither very wet nor very dry (much vegetation adjacent to wetlands is MESOPHYTIC in nature).

MUCK: a type of surface deposit in a poorly drained area, consisting of much dark, partially decomposed organic matter intermixed with mineral matter.

MUDFLATS: an area usually supporting only sparse vegetation or no vegetation at all, although algae may be numerous on such sites; mudflats may be intertidal in coastal areas or associated with areas of widely fluctuating water levels inland.

MUSKEG: a term used in several different ways but usually referring to bog (in itself a poorly defined term) habitats of the far north.

NEEDLE-LEAF: a descriptive term used in referring to the usually slender, often evergreen, leaves of many gymnosperms (e.g., pine).

NONVASCULAR PLANT: referring to the simple (and usually small and inconspicuous) plants characterized by a lack of specialized conducting and supporting tissues (e.g., algae).

NONWOODY: referring to a plant that does not form long-lived above ground structures; plants other than trees and shrubs.

OPEN WATER: areas that support very little vegetative cover (25 percent or less); such areas comprise the permanent or semipermanent interior portions of many ponds and lakes.

OXBOW: a shallow, crescent-shaped lake that results when loops of a meandering stream are cut off; oxbows are very common in deltaic regions.

PEAT: a dark-brown or black substrate produced by the partial decomposition and disintegration of mosses, sedges, trees, and other

plants growing in areas of its deposition; peat characteristically is deposited in certain wetland types.

PERCHED WETLANDS: wetlands located away from significant stream influence; perched wetlands include potholes and many so-called bogs, swamps, and similar areas vegetated by marsh or swamp plants.

PERENNIAL: a woody or herbaceous plant living from year to year, normally not dying after once flowering.

PERIPHYTON: algae growing attached to rocks and vegetation.

PERMANENT: used in reference to bodies of water that are long persistent and not subject to the normal processes of drying out by evaporative forces.

PHREATOPHYTE: a plant that has roots extending into the water table, thereby attaining a permanent water supply; of major concern in arid areas.

PHYSIOGNOMY: a descriptive concept based on the external appearance of vegetation (e.g., forest, prairie, marsh, etc.).

PHYTOPLANKTON: small, free-floating or weakly swimming algae, restricted to the very upper levels of bodies of water.

PLAYA LAKE: a slight depression in the plains of the Interior region, containing water after heavy rains but dry at other times, often supporting distinctive vegetation.

PNEUMATOPHORE: slender conical roots that grow vertically out of the mud, found in certain types of mangroves; used in conduction of oxygen to underground root systems.

POCOSIN: a regional term applied in the Carolinas to upland bogs found in undrained, shallow depressions in pine savannahs; pocosins are dominated by evergreen shrub species.

POND: a small, quiet body of standing water, usually sufficiently shallow to permit the potential growth of rooted plants from shore to shore.

POTHOLES: wetlands occupying basins formed by melting of isolated chunks of buried ice left behind by receding glaciers.

PRODUCTIVITY: the rate at which energy is stored in the form of organic substances, which can be used as food materials.

RESERVOIR: a pond or lake build for storage of water, usually by construction of a dam across a stream or river.

RHIZOME: an underground stem, growing horizontally, often thickened and containing accumulations of reserve food material; important structure for vegetative reproduction in many wetland plant species.

RIPARIAN: pertaining to vegetation of a riverbank or streamside.

SALINA: the term used for coastal flat (salt flat) in Puerto Rico.

SALINE: referring to water having too much salinity to be considered fresh water (in common usage the term is applied to water of high salinity, i.e., in excess of 30 ppt).

SALINE FLAT: wetlands having 25 percent or less vegetative cover that are occasionally or regularly flooded by saline water or nontidal origin (e.g., salt flats in interior of U. S.).

SALINE WATER: water containing greater than 30 ppt (o/oo) salinity.

SALINITY: pertaining to the percentage of salt found in saline water.

SALT FLAT: any area having high concentrations of soil salinity and supporting little or no vegetation, may be either coastal or inland.

SALT WATER: water containing high concentrations of salinity; normally the term is used to refer to sea water.

SALTWATER AQUATIC WETLAND: a wetland that is dominated by free-floating rooted, or otherwise attached herbaceous plants (including macroscopic marine algae) and that are permanently flooded by saline or brackish water (e.g., seagrass beds).

SALTWATER MARSH: a wetland having saline (including brackish) soils with 40 percent or less cover by woody plants and 25 percent or more cover by terrestrial herbs that is occasionally or regularly flooded by brackish or saline water (e.g., smooth cordgrass marshes).

SALTWATER SWAMP: a wetland having saline (including brackish) soils with 40 percent or more cover by woody plants and occasionally or regularly flooded by brackish or saline water (e.g., mangrove swamps).

SANDBAR: a bar or low ridge of sand bordering the shore or near the surface of the water, built up by currents or wave action.

SEAGRASS BEDS: usually areas of shallow water located along the coastline that support the underwater growth of seagrasses; of great value in providing cover for spawning fish and for their great productivity.

SEAWEED: any of the various macroscopic forms of marine algae (either Red algae, Brown algae, or Green algae).

SEDGE: any member of the plant family Cyperaceae; often used to refer to the specific genus *Carex* of the Cyperaceae.

SEMIPERMANENT: referring to a body of water that under normal circumstances is long persisting but under certain conditions may dry up in response to the normal processes of evaporation.

SHALLOWS: wetlands that are not usually considered marsh; represented by shallow pools, salt pans that hold water, and shallow lakes in estuarine systems; they may be nonvegetated or vegetated with emergent or submergent vascular plants or algae.

SHRUB: a perennial woody plant of relatively low stature (usually considered less than 20 ft) with several to many stems from at or near the ground.

SHRUB BOG: any permanently waterlogged peatland dominated by shrubs.

SINKHOLE: a characteristic feature of karst topography in limestone areas; a depression or "sink" occurs when the underlying limestone is eroded through solution processes; the sinkhole may or may not hold water.

SLOUGH: a channel of slow-moving water in a region having little topographic relief.

SOUND: a wide channel or strait connecting two large bodies of water or separating an island from the mainland.

SPECIES: a taxonomic category below the rank of genus representing a group of closely-related individuals that actually or potentially interbreed (e.g., the genus *Typha* contains several species of Cattail: *T. latifolia, T. angustifolia,* and *T. domingensis;* the species are considered to be closely related and hybridization is common in Cattails).

SPECIFIC EPITHET: the term referring to the scientific name applied to each species within a genus (e.g., *latifolia* is the specific epithet of the species *Typha latifolia*).

STAND: a group of plants on a given sample area.

STRAND VEGETATION: a term defined in several different ways, usually referring to the vegetation at the very edge of the shore (exclusive of any adjacent areas, such as dunes).

STREAM: any mass of water with a unidirectional flow.

SUBMERGED: referring to a hydrophytic plant that grows characteristically completely under water.

SUBMERGENT: same as SUBMERGED.

SUBMERSED: same as SUBMERGED.

SUCCESSION: the gradual, usually orderly and sometimes predictable sequence of plant communities occupying a given area with the passage of time.

SUCCULENT: a plant having juicy and fleshy stems and leaves that are adapted for water storage.

SWAMP: a wetland in which the dominant vegetation consists of trees (greater than 40 percent cover), tidal or nontidal, saltwater or freshwater.

TIDAL: referring to the alternate rise and fall of waters along the coast or of those having coastal influence.

TIDAL CREEK: a wetland situated along channels where water flows in both directions due to tidal influence.

TRANSITION ZONE: also referred to as ECOTONE; the intermediate zone between two or more adjacent plant communities, usually containing species from each of the adjacent vegetation types.

TREE: a perennial woody plant usually having a single trunk or stem and usually more than 6 m in height.

TUNDRA: a treeless plain, either wetland or "dry," found between the northern limits of trees and the region of perpetual ice and snow in the far north, or above treeline in the high mountains.

UPLANDS: areas that are not flooded on a regular basis and that do not support vegetation dominated by hydrophytes.

VASCULAR PLANT: referring to any of the many kinds of plants having specialized conducting and supporting tissue as well as differentiation into the structures known as roots, stems, and leaves (e.g., trees and shrubs of all kinds, grasses, etc.).

VEGETATIVE COVER: a term used in quantitative vegetation sampling, referring to the amount (percent) of ground with vegetation above it; estimated by vertically projecting the outline of leaves onto the ground.

VEGETATIVE REPRODUCTION: in seed plants, referring to reproduction by any of several means other than by seeds (e.g., underground rhizome systems, formation of roots on detached stems and leaves, etc.).

VERNAL POOL: a regional term applied to depressions in the grassland area of California; these pools, supporting a distinctive assemblage of plant species, fill with water in winter but dry up by summer.

WATER TABLE: the surface of the water-saturated zone of permeable rocks.

WETLANDS: those areas that are inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

WET MEADOWS: graminoid-dominated marshes, often with a wide variety of associated species, often found along floodplains where freshwater swamps have been cleared.

WILLOW HEAD: willow-dominated freshwater swamp occurring in southern Florida.

XERIC: pertaining to an area or habitat having a very low or inadequate moisture supply; plants of such habitats are XEROPHYTIC.

APPENDIX C: INTERPRETATION OF WETLAND DEFINITION

1. An area of some concern with respect to policy in the interpretation of the wetland definition is inclusion of the littoral zone as a wetland. In bodies of fresh water, the littoral zone is that area extending from the shoreline into the water to the limits of occupancy by rooted plants. The littoral zone has been defined in several ways by various marine science disciplines but usually is used as more-or-less synonymous with the intertidal zone (that region between high and low tides). Most intertidal littoral habitats (such as marine seagrass beds, macrophytic algal beds, rocky shores, and flats; as well as freshwater habitats such as mud flats and submerged aquatic plant beds) were regulated prior to the Federal Water Pollution Control Act Amendments of 1972, in large part by Sections 9 and 10 of the River and Harbor Act of 1899.

2. The emphasis in this report is on plant communities and their transition zones, and, from a technical standpoint, it is unrealistic to exclude the littoral zone plant communities from technical consideration. The reason for this is that plant communities are dynamic entities that are subject to considerable variation with respect to their position along various environmental gradients, and thus cannot be delineated precisely by policy statements that fail to take field realities into account. Seagrass beds, for example, usually are considered permanently inundated habitats; den Hartog,* however, reports that of the 12 genera of seagrasses, only three (none of which occur in American waters) occur exclusively in permanently flooded habitats.

3. For technical purposes, therefore, a broad definition of wetland has been followed in this guidebook series; although for purposes of practical delineation of wetlands from a standpoint of policy regulatory functions, personnel may find it necessary to follow a narrower definition.

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* C. den Hartog. 1977. Structure, function, and classification in seagrass communities. in C. McRoy and C. Helfferich, eds. Seagrass ecosystems. Marcel Dekker, Inc., New York.

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